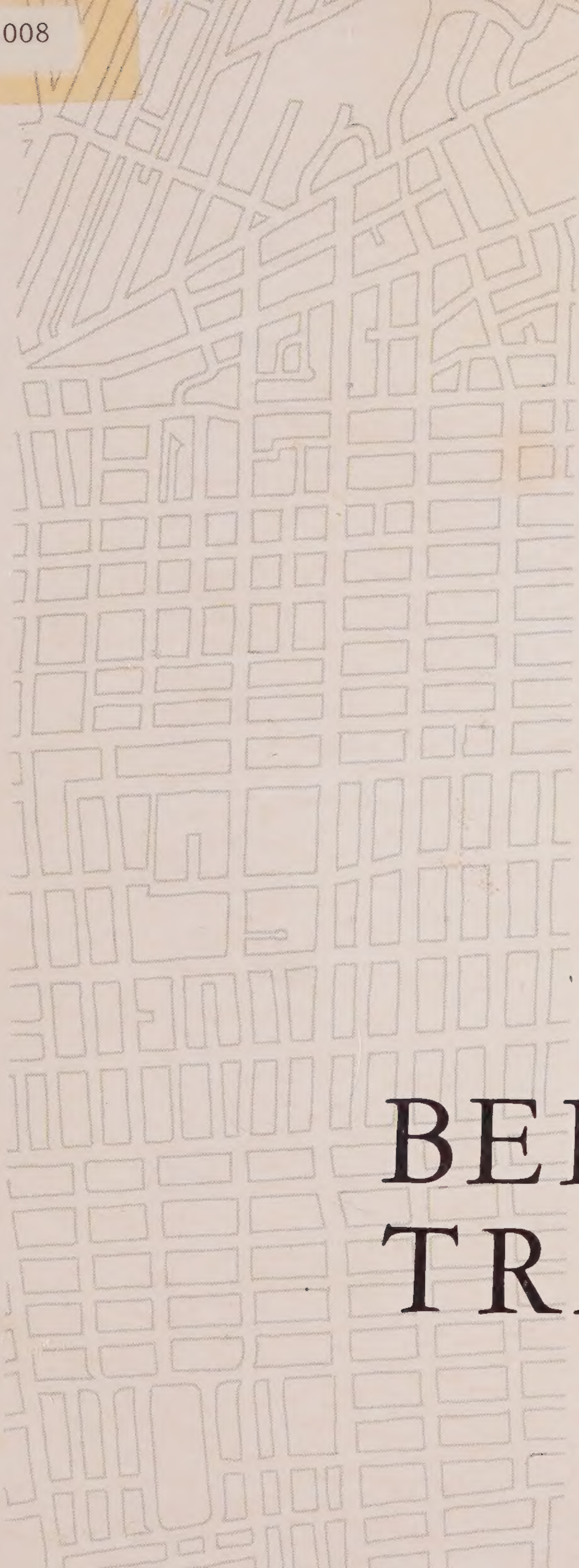

BERKELEY TRAFFICWAYS

Wilbur Smith and Associates

7804008

Prepared for

CITY OF BERKELEY, CALIFORNIA

February, 1965

BERKELEY TRAFFICWAYS

Wilbur Smith and Associates

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CONSULTING ENGINEERS

580 MARKET STREET
SAN FRANCISCO, CALIF.
YUKON 2-3221

February 15, 1965

Mr. John D. Phillips
City Manager
City of Berkeley
Berkeley, California

Dear Mr. Phillips:

We are pleased to submit our study of trafficways in the City of Berkeley, prepared pursuant to our agreement of February 4, 1964.

The report contains an analysis of existing conditions, projections of future traffic volumes, evaluations of new requirements, and consideration of alternative courses of action. A Trafficways Plan is proposed, and a program of action suggested. The plan is designed to provide adequate service for 1980 traffic volumes. Recommendations have also been made for immediate improvements needed to relieve existing deficiencies in the street system.

It is estimated that capital expenditures in the order of $34.4 million will be required by 1980 to meet the basic needs for traffic service on the Berkeley City street system. This cost does not include possible highway construction by the State of California, but does include projects to be effected by the Bay Area Rapid Transit District as part of its station construction program.

We would like to express our appreciation to the members of your staff for the fine cooperation extended to our Project Engineer Robert Jaffe and Planner Warren Anderson during the course of this study.

Very truly yours,

Henry K. Evans

Henry K. Evans, Manager
Western Division

State of California
Professional Engineer No. 7534

SUMMARY OF FINDINGS

At the present time the Berkeley trafficways system is in need of substantial improvement to overcome existing deficiencies and to meet the demands which will accompany growth in the future. While the pattern of the city's street network provides a good basis for an adequate circulation system, many of the trafficways are now inadequate in terms of width. Many important streets are carrying traffic volumes in excess of their practical capacities, causing traffic congestion and high accident rates. In addition, the structural condition of many of the city's trafficways requires improvement now or in the near future.

Within the next five years traffic growth will bring increased demands upon the city's trafficways. The development of the Marina area, the redevelopment of the West Berkeley Industrial Park and the South Campus areas, construction of the Bay Area Rapid Transit System and growth of areas adjacent to Berkeley will require street construction and widening.

The existing street system has been examined in detail, including traffic volumes, accident experience, operating speeds, and structural conditions. On the basis of these data a sufficiency rating was prepared for each segment of the system. While the rating thus developed does not yield an automatic program of priorities, it does serve to indicate areas of concern. This knowledge, together with other criteria -- such as the interrelationship with other projects, the cost of the project, the effectiveness of interim improvements, and the planning goals of the city -- were used to develop a two-phase plan for capital improvements.

A trafficways plan providing adequate capacity for the demands of traffic estimated for 1980 and consistent with the goals of the Berkeley Master Plan has been prepared.

Grove Street, University Avenue, Hearst Avenue, and Ashby Avenue will require major street widening projects to meet 1980 demands. Ashby Avenue, which has previously been indicated as the route of a freeway facility linking Berkeley with the Caldecott Tunnel, has been considered as a conventional surface street as directed in the contract with the City. There is, however, an obvious need for a freeway to serve 1980 demands in this corridor. The City is urged to support the early development of a second freeway facility to relieve the congested Eastshore Freeway-San Pablo Avenue corridor. A second freeway in this area will provide needed additional capacity within the corridor and make possible connections of two east-west major streets -- Dwight Way and Cedar Street -- which now have no freeway access. Other recommended major construction projects are the Telegraph Avenue one-way pair in the South Campus area, the Dwight Way - Haste Street connection at Grove, and a major realignment of the Gilman-Hopkins-Sacramento-Monterey complex.

The Bay Area Rapid Transit line will require substantial improvements in the areas surrounding each of the three Berkeley passenger stations. Street improvement projects must be coordinated with rapid transit construction. The bus transit routes of the Alameda-Contra Costa Transit District will also require revisions to meet changing rider needs. A proposed study in depth -- to be financed jointly by the Federal Housing and Home Finance Agency, the Bay Area Rapid Transit District, the Alameda-Contra Costa Transit District, and the San Francisco Municipal Railway will develop a detailed factual basis for these changes, including route changes, fares, transfers, and operating schedules.

A three-part program of improvements has been proposed to implement the recommended Berkeley Trafficways plan. In the first stage, basic traffic engineering improvements such as curb parking removal and development of new one-way streets have been suggested to relieve existing deficiencies.

Next, two programs of capital improvement have been suggested. The first, to be effected by 1970, totals approximately $10.4 million, of which a part will be assumed by the Bay Area Rapid Transit District in connection with its passenger station construction projects. A second improvement phase, estimated to cost $24 million, is to be accomplished between 1970 and 1980. It is assumed that some part of this total will be included in State funds made available for the improvement of Ashby Avenue, which is a State Highway. The two tables which follow summarize the two phases of capital improvements recommended to accommodate the demands for traffic service which can be anticipated from now to 1980 within the City of Berkeley.

CAPITAL IMPROVEMENTS NEEDED BY 1970
Berkeley Trafficways Study

STREET	LIMITS	COST	REMARKS
Acton St.	Cedar-University	$ 90,900	Widen to 40'
Adeline St.	Alcatraz-Woolsey	107,600	Divided 44' roadways
	Woolsey-Ashby	61,100	See Figure 14
	Ashby-Ward	86,150	Divided 36' roadways
	Grove-South City Limit	64,700	Intersection redesign & reconst'n.
Alcatraz Ave.	Essex-Sacramento	55,600	Widen to 44'
Allston Way	Shattuck-Oxford	28,900	Widen to 40'
	Sacramento-Sixth	196,600	Widen to 40'
Allston-Second St.	University-Sixth	149,300	New 48' rdwy. & widening to 48'
Arlington Ave.	North City Limit-The Circle	418,600	Widening and reconstruction
Ashby Ave.	Shattuck-Ellis	1,419,200	Dual 24's and 48'
California St.	-	8,000	Install diverters
Delaware St.	Sacramento-Sixth	210,500	Dual 24's and 48'
	Sixth-Fifth	17,200	Widen to 48'
Del Norte St.	Sutter-The Circle	25,000	Widen to 40'
Dwight-Haste Conn.	Grove-Grant	377,800	New 44' roadway
Ellsworth St.	Bancroft-Ashby	241,000	Widen to 44'
Euclid Ave.	Hearst-Cedar	71,900	Widen to 40'
Fulton St.	Bancroft-Durant	200,300	Widen to 84'
	Durant-Ashby	241,100	Widen to 44'
Gayley Rd.	Hearst-Bancroft	142,300	Widen to 48'
Gilman-Sacramento	Hopkins-Rose	550,000	New connections
Glendale St.	Intersection at La Loma	32,000	Intersection redesign
Grove St.	South City Limit-Alcatraz	87,100	Divided 42' roadways
	Adeline-Ashby	72,000	See Figure 14
	Ashby-Stuart	78,500	Widen to 64'
Hearst Ave.	East Frontage Rd.-Fifth	72,000	Widen to 48'

CAPITAL IMPROVEMENTS NEEDED BY 1970
Berkeley Trafficways Study

STREET	LIMITS	COST	REMARKS
Hearst Ave.	Arch-Euclid	$ 51,200	Reconstruction and widening
	Euclid-Highland	97,000	Widen to 44'
	Milvia-Shattuck	486,000	Divided 32' roadways
	Sacramento-Milvia	234,700*	Divided 32' roadways
Hopkins St.	Gilman-Monterey	39,700	Widen to 40'
La Loma Ave.	Hearst-Le Conte	32,200	Widen to 40'
Le Conte Ave.	Hearst-La Loma	96,200	Widen to 40'
Ridge Rd.	Le Conte-La Loma	65,100	Widen to 40'
Sacramento St.	Oregon-South City Limits	176,800	Divided 36' roadways
Shattuck Ave.	Ward-University	341,100	Divided 46' roadways
Shattuck Ave. Ext.	University-Berkeley Way	270,000	New 36' roadway
Telegraph Ave.	Bancroft-Dwight	29,700	Reconstruction
	Parallel facility	2,580,250	New 40' roadway
University Ave.	Marina Blvd.-Eastshore Fwy.	165,000	Divided 32' roadway
	Fifth-Grove	459,300	Divided 32' roadways
	Grove-Oxford	140,700	Divided 32' roadways
Woolsey St.	Shattuck-Grove	28,000	Reconstruction
TOTAL IMPROVEMENT COST		$10,390,300	

*Does not include r/w costs to be borne by BARTD.

CAPITAL IMPROVEMENTS NEEDED BY 1980
Berkeley Trafficways Study

STREET	LIMITS	COST	REMARKS
Alameda, The	Solano-Hopkins	$ 85,300	Reconstruction
	Thousand Oaks-Solano	57,500	Reconstruction
Alcatraz Ave.	Sacramento-Dover	98,100	Widen to 44'
	College-Claremont	30,000	Widen to 44'
Allston Way	Sacramento-Shattuck	166,300	Widen to 44'
Ashby Ave.-Tunnel Rd.	Eastshore Fwy.-Ellis Ellis-E. City Limit	7,422,000	Divided 36' roadways
Cedar St.	Marina Blvd.-Eastshore Fwy.	178,500	New 48' roadway
	Eastshore Fwy.-Sacramento	936,400	Widen to 44'; R.R. grade separation
	Sacramento-La Loma	368,200	Widen to 44'
College Ave.	Bancroft-South City Limit	300,000	Widen to 44'
Colusa Ave.	North City Limit-Catalina	69,800	Reconstruction
	Catalina-Marin	228,200	Eliminate off-set & reconstruction
Derby St.	Sacramento-Warring	300,000	Widen to 40'
Durant Ave.	Shattuck-Piedmont	135,800	Reconstruction
Dwight Way	Shoreline Fwy.-S.P.R.R.	4,500,000	Structure
	S.P.R.R.-Grant	2,240,800	Divided 36' roadways
	Grant-Shattuck	49,700	Widen to 44'
	Shattuck-Telegraph	117,300	Widen to 44'
	Telegraph-Piedmont	133,100	Widen to 44'
	Piedmont-East City Limit	40,000	New 40' roadway (City of Berkeley share)
Euclid Ave.	Cedar-Grizzly Peak	296,000	Reconstruction
Gilman St.	Marina Blvd.-Eastshore Fwy.	264,000	New 48' roadway
	Eastshore Fwy.-San Pablo	894,300	48' roadway, R.R. grade separation
	San Pablo-Hopkins	179,000	Widen to 44'
Grove St.	Hopkins-Stuart	2,422,200	Widen to 64'

CAPITAL IMPROVEMENTS NEEDED BY 1980
Berkeley Trafficways Study

STREET	LIMITS	COST	REMARKS
Haste St.	Grove-Piedmont	73,400	Widen to 44'
Hopkins St.	Carlotta-Sutter	124,500	Reconstruction
	Gilman-San Pablo	108,300	Reconstruction to 40' width
Keith Ave.	Spruce-Shasta	74,800	Reconstruction
La Loma Ave.	Cedar-Buena Vista	14,500	Reconstruction
Marin Ave.	West City Limit-The Alameda	61,700	Reconstruction
Marina Blvd.	University-Gilman	264,400	New 48' roadway
Milvia St.	Dwight-Channing	40,000	Widen to 40'
	Center-Cedar	129,300	Widen to 44'
Oxford St.	Virginia-Rose	95,500	Widen to 44'
Piedmont-Warring-Derby-Belrose-Claremont Rd. Rte.	Bancroft-Claremont Ave.	162,300	Reconstruct Piedmont and Warring; widen others to 44'
Glendale-Delmar-Campus-Queens-Avenida	La Loma-Grizzly Peak	52,300	Widen to 32'
Glendale-Campus	La Loma-Shasta	49,200	Widen to 32'
Sacramento St.	Dwight-University	161,800	Divided 33' roadways
Santa Fe Ave.	North City Limit-Gilman	75,000	Widen to 40'
Seventh St.	Dwight-Ashby	168,000	Widen to 48'
Shasta Rd.	Keith-Grizzly Peak	93,200	Reconstruct to 40'
	Grizzly Peak-Tilden Park Gate	10,000	Widen and reconstruct
Solano Ave.	W. City Limit-Alameda	62,000	Reconstruction
Spruce	Vine-Eunice	95,500	Widen to 44'
	Eunice-Marin	94,300	Widen to 40'
	Marin-Grizzly Peak	111,000	Reconstruct to 36'
Telegraph Ave.	Dwight-South City Limit	302,300	Divided 33' roadways
Thousand Oaks Blvd.	Colusa-Arlington	42,300	Reconstruction
TOTAL IMPROVEMENT COST		$23,978,000	

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I INTRODUCTION

The City of Berkeley, a city of some 120,000 persons, is located on the eastern shore of San Francisco Bay, occupying a unique spot in the social and economic life of the Bay Area. While San Francisco and Oakland are both dominant elements in the area, Berkeley has developed certain facilities and a particular way of life which make it a much more complex organism than a mere satellite of the two larger cities. In spite of the high percentage of Berkeley residents who travel to Oakland, San Francisco and other areas for work, Berkeley is not a "bedroom" community; rather, there is a large amount of commercial and industrial employment within its limits and these land uses are increasing in importance. The Berkeley campus of the University of California is an important part of the city and has had a great influence on development and character of the community, but it is not the dominant element. Berkeley is composed of a variety of activities which make it an interesting, complex and variegated city.

At the present time certain of the arterial and secondary streets within the City of Berkeley are inadequate with respect to demands for traffic service and others are rapidly approaching this condition. Traffic growth in the area is creating heavier demands on the city street network. In addition, the construction of the Bay Area Rapid Transit system will introduce problems with respect to the existing network of streets and highways. With these factors in mind, the City of Berkeley retained the firm of Wilbur Smith and Associates to study the existing major street network and to evaluate the changes and improvements which will be necessary in the next 15-year period. The findings of this study are presented in this report, together with a recommended major street and highway plan.

Study Purpose and Scope

This study is concerned with the following major areas of inquiry, each of which is examined in later sections of the report:

1) Review and analysis of the Berkeley Master Plan and other planning studies to determine the adequacy of the existing plan of streets and highways,

2) Review and analysis of traffic data to determine the sufficiency of the existing system of streets and highways with respect to present demands for traffic service,

3) Reevaluation of traffic growth forecasts in the light of changed land-use estimates, the introduction of rail rapid transit, and improved local transit service,

4) Estimates of anticipated traffic volumes on the city's street and highway system by the year 1980,

5) Preparation of a long-range plan of streets and highways necessary to meet 1980 demands, together with a recommendation for a capital improvement program necessary to implement the plan,

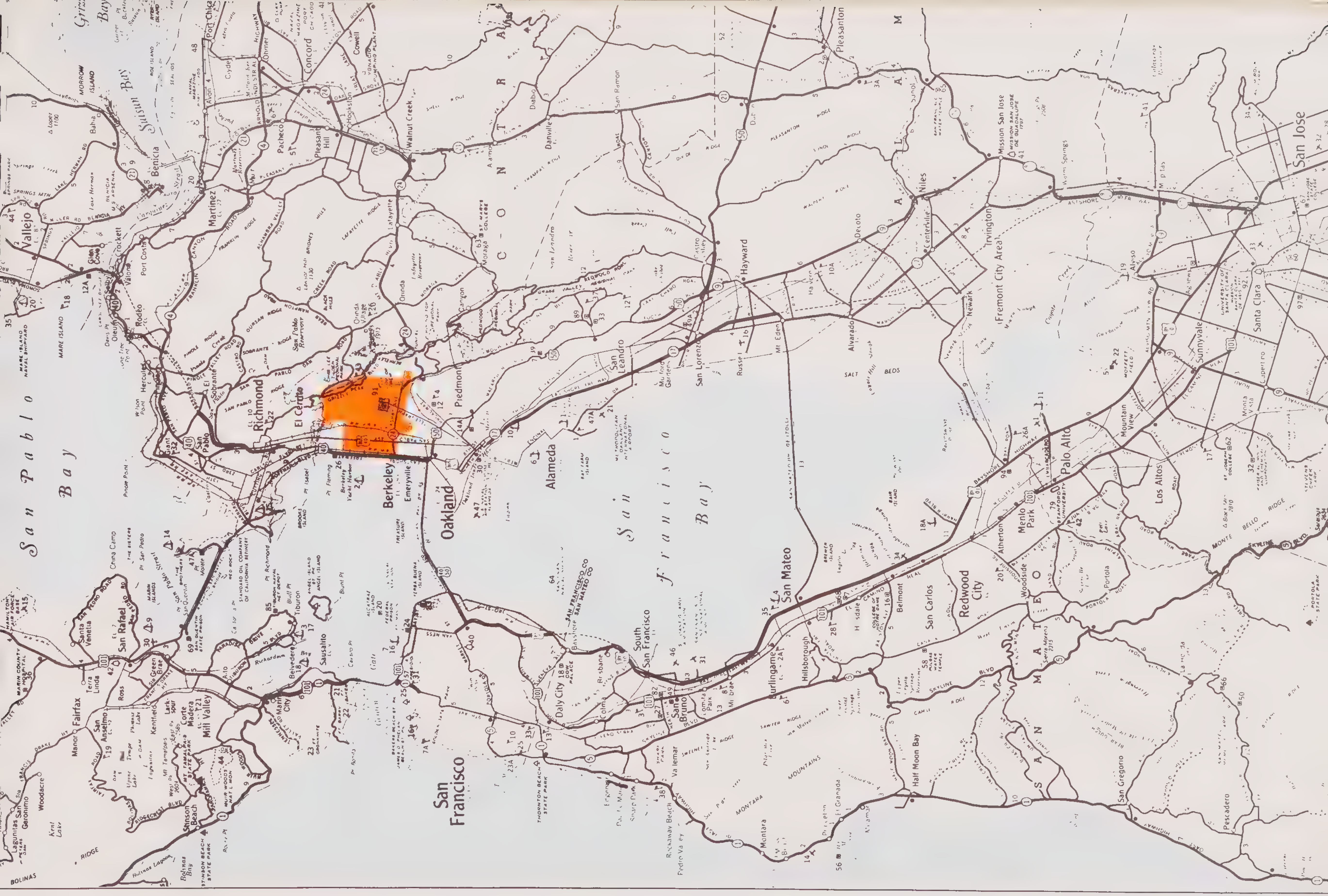
6) Recommendations as to the proper integration of municipal planning with the construction of the Bay Area Rapid Transit facilities.

Study Area

The area of study for this report is the City of Berkeley (Figure 1). In addition, the prospects of future filling of the San Francisco Bay have been taken into consideration.

Previous Studies

In this study, a number of previous investigations have been utilized. In addition to the many maps and other documents prepared by the City of Berkeley, the following reports proved to be of particular benefit:



1
LOCATION MAP

NORTH

BERKELEY TRAFFICWAYS
Wilbur Smith and Associates

Report on a Trafficways Plan for the Central Area, Berkeley, California, prepared by DeLeuw, Cather and Co., December, 1956.

Report on a Proposed Alameda County Highway Master Plan, prepared by Wilbur Smith and Associates, 1959.

Report on the Abandonment of Bancroft Way, prepared by J. D. Phillips, City Manager, 1963.

Preliminary Berkeley Hill Area Trafficways Plan, prepared by the Berkeley Planning Department, 1963.

Traffic and Parking Study, Berkeley South Campus Urban Renewal Area, prepared by Wilbur Smith and Associates, Vol. 1, 1963, Vol. 2, 1964.

Short-Haul Transportation on the Berkeley Campus -- 1970, prepared by Wolgang S. Homburger, University of California.

Berkeley Master Plan, prepared by Berkeley Planning Commission and adopted by the Berkeley City Council, as amended to July, 1963.

Population and the Berkeley Master Plan, Berkeley City Planning Department, June, 1961.

Population Trends in Alameda County, Council of Social Planning, Alameda County, April, 1963.

Long Range Development Plan, University of California, June, 1962.

Berkeley Marina Development Plan, Livingston and Blayney, John A. Blume and Associates; and John Carl Warnecke and Associates, Sept., 1960.

Development Opportunities at Berkeley Marina, City of Berkeley, 1964.

Field Studies

To supplement the data contained in the reports noted above and that made available by the Public Works and Planning Departments of the City of Berkeley, certain field studies were necessary for the completion of this study. Among these were a series of 24-hour traffic counts taken at key

locations on arterial streets to evaluate existing conditions, and travel time studies on certain of the "problem" arterials to determine the relative level of traffic service now being provided.

II EXISTING STREETS AND HIGHWAY SYSTEM

In this chapter the characteristics of the existing network of streets and highways are described. Included are its pattern and development, the traffic controls, and public transit service.

Regional Routes

Berkeley is served by three major highways which provide access to outlying areas. The first of these, the 8-lane Eastshore Freeway (U.S. 40; I-80), serves north-south movements along the eastern side of the San Francisco Bay and affords connections, by way of the Bay Bridge, to San Francisco and, via the Richmond-San Rafael Bridge, to Marin County. This freeway is reached from Berkeley via interchanges with Gilman Street, University Avenue, and Ashby Avenue.

San Pablo Avenue (U. S. 40-Business) is a 6-lane, undivided arterial which runs from the MacArthur Freeway (U. S. 50) in Oakland through Berkeley, Albany and El Cerrito to the City of Richmond. Extensive commercial development has taken place along this route and it is important both as a local and as a regional route.

Ashby Avenue (State Highway 24) serves as the major east-west route providing a connection on the east to the Walnut Creek-Concord area via the Caldecott Tunnel, and to the Eastshore Freeway on the west end as noted above.

Major Streets

Figure 2 illustrates the existing street and highway system of the City of Berkeley. In addition to the regional routes discussed above, those streets designated as arterial streets -- classified as major thoroughfares, secondary thoroughfares, or feeder streets by the current Berkeley Master Plan -- are indicated.

The street system of Berkeley can be divided into two parts. The first, present in the relatively

2

CIRCULATION SYSTEM
BERKELEY MASTER PLAN, 1961
AMENDED TO OCTOBER, 1964

LEGEND

FREEWAY
MAJOR THOROUGHFARE
SECONDARY THOROUGHFARE
FEEDER STREET

NORTH

0 1 2 3 4 5 6

MAP SCALE IN THOUSANDS OF FEET

BERKELEY TRAFFICWAYS

Wilbur Smith and Associates

flat areas of the city, is characterized by the grid patterns of early subdivisions, broken occasionally by radial streets. In the hill areas a completely different pattern of streets has developed, designed to accommodate the restrictions of topography. Unlike the pattern in the flat areas, where a large number of streets extend for long distances, the hill area street network has few streets with tolerable grades extending for any distance. Spruce Street, Euclid Avenue, and Arlington Avenue connect the residential hill areas to the more level part of Berkeley where the commercial and industrial areas are concentrated.

Among the major east-west thoroughfares serving Berkeley, the most important is University Avenue. This major street has its westerly terminus at the Berkeley Marina and Public Fishing Pier, near which is also located the Berkeley Heliport. At this point is also located one of the three interchanges with the Eastshore Freeway which serve Berkeley. Like San Pablo Avenue, University Avenue is heavily developed along most of its length with commercial activities. Its eastern terminus is at the campus of the University of California, and near its intersection with Shattuck Avenue is located the central business district of the city.

Among the other principal east-west thoroughfares within the City of Berkeley, Gilman Street serves an important role because of its interchange with the Eastshore Freeway and because it, with Hopkins Street, provides for movement across an area with a street system with few east-west streets of any length. This street also serves a substantial industrial area located between San Pablo Avenue and the freeway. Cedar Street now carries east-west through traffic within the city, but, because it does not connect with the freeway, it is not used to the same degree as Gilman and University. Solano Avenue, a major and secondary street within the City of Albany, is also important in Berkeley. The situs of a substantial strip commercial development, the street also serves an important local circulatory function.

Principal north-south traffic arteries include Sacramento Street (a 4-lane, divided street), Grove Street, Adeline Street, Shattuck Avenue, Telegraph Avenue, 6th-7th Street, Piedmont-Gayley Road, and College Avenue. Shattuck and Telegraph, in addition to their arterial functions, have evolved into dominant commercial streets, Shattuck serving as an axis for CBD development, while Telegraph is the axis for a unique commercial development oriented toward the University campus community.

One-Way Streets

Only a limited number of one-way streets have been developed in Berkeley (see Figure 2). In the South Campus area, where traffic volumes are relatively heavy, two east-west pairs of one-way streets -- Dwight-Haste and Bancroft-Durant -- have been established. Along the western border of this area, the Fulton-Ellsworth pair serves north-south traffic between Bancroft and Ashby Avenue.

Some of the efficiency of the one-way patterns is lost at the terminal points. For example, traffic travelling west on Haste Street is forced at Grove (where Haste now dead-ends) to find an alternative route to continue its west-bound movement. This condition results in two effects: (1) some drivers avoid the street in anticipation of this difficulty, and (2) the traffic which does use the street contributes to the loading of Grove, thus creating traffic problems on this street. A similar but less serious situation obtains on the Fulton-Ellsworth couplet. Here northbound traffic on Ellsworth is routed over Bancroft to avoid the barrier of the University campus.

It should be noted that the City's Master Plan recommends against the extension of one-way streets through residential neighborhoods because of the undesirable introduction of heavy volumes onto local streets.

Public Transit

In addition to facilities for transportation by automobile, Berkeley is well served by buses of the Alameda-Contra Costa Transit District. In Figure 3 the routes of the buses serving Berkeley are

3

1964 TRANSIT ROUTES

LEGEND

F ——— TRANSBAY ROUTES

7 ——— LOCAL ROUTES

AREA WITHIN WALKING DISTANCE OF TRANSIT ROUTE

NORTH

0 1 2 3 4 5 6

MAP SCALE IN THOUSANDS OF FEET

BERKELEY TRAFFICWAYS

Wilbur Smith and Associates

illustrated. Lines E, F, G, and H provide service to San Francisco via the Bay Bridge. Fifteen additional lines afford local access within Berkeley itself or to the neighboring cities of Oakland, Albany, El Cerrito, and Richmond. As shown in Figure 4, after a long period of declining patronage, the Transit District is now slowly gaining passengers. Bus stops vary in location, some being located at the intersection approach, and others located on the far sides of intersections, generally conforming with current recommended practice.[1]

Curb Parking

Curb parking is permitted throughout most of the city. While most of such parking is parallel to the curb, diagonal parking is permitted along both sides of University Avenue from Sixth to Shattuck and along Shattuck Avenue south of University. In certain areas along Shattuck, parking areas have been developed in the wide center island formerly used for the defunct Key System transit right-of-way.

Curb parking time limits within the areas of significant commercial development are normally controlled by meters or signs. Time limits ranging from 24 minutes to 2 hours are in effect. In other areas where long-term parking is to be discouraged, parking spaces are posted with time limit signs. Surveillance of controlled parking spaces appears to be effective in securing a high degree of conformity to the posted time limits.

Peak-Hour Regulations

To increase the capacity of major thoroughfares for peak-hour volumes, certain types of activities are restricted such periods of the day.

Parking Restrictions -- Peak-hour parking restrictions to increase the capacity of arterial streets have been applied to a limited degree in Berkeley. At present such restrictions are in effect at only 8

[1] Proper Locations for Bus Stops, Institute of Traffic Engineers, Washington, D. C., 1954.

4

TREND IN TRANSIT USAGE

ALAMEDA-CONTRA COSTA
TRANSIT DISTRICT & PREDECESSOR COMPANIES

locations, shown in Figure 5. Except on Fulton Street, a one-way street, Del Norte Street, on which parking is restricted on the east side 7:00 to 9:00 A.M. and 4:00 to 6:00 P.M., and Oxford Street, on which parking is restricted on the east side 7:00 to 9:00 A.M. only, parking is prohibited on the side with the peak load during the morning or evening peak hours. Thus, on Ashby Avenue, parking is prohibited on the north side of the street in the morning to facilitate the westbound peak movement and on the south side in the evening to accommodate the peak east-bound movement.

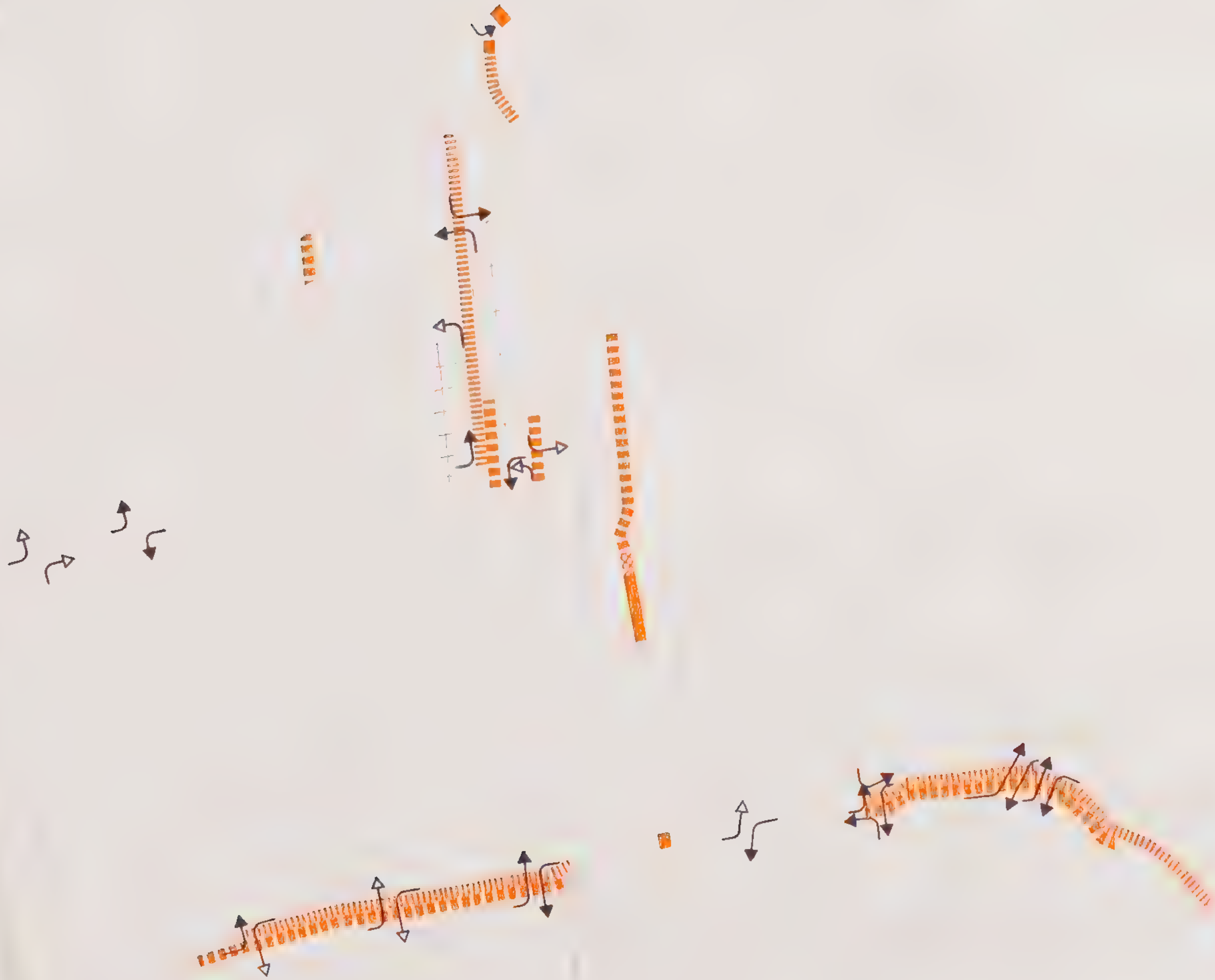
At one location, on Acton Street between University and Addison, parking is restricted between the hours of 8:00 A.M. and 4:00 P.M..

Left-Turn Restrictions -- Left-turning vehicles can cause severe problems on a major thoroughfare, especially at congested intersections. If no special phase is provided in the signal timing, opposing traffic must be prepared to halt to allow the turning vehicles to cross. Congestion behind the turning vehicle is also common where no exclusive turn lanes are provided. For this reason, the prohibition of left turns from heavily traveled thoroughfares has become accepted as a necessary part of providing needed peak-hour capacity in urban areas.

As indicated in Figure 5, left turns are now prohibited at 16 intersections between the hours of 4:00 and 6:00 P.M. and at 10 locations between the hours of 7:00 and 9:00 A.M.. Left turns from Solano Avenue north onto Del Norte Street are prohibited at all times because of the proximity to the tunnel portal. Unlike the enforcement of parking restrictions, the enforcement of left-turn prohibitions does not appear to be entirely successful.

Traffic Control Devices

The locations of traffic controls on the Berkeley street system are shown in Figure 6. Among the devices in use to regulate the flow of traffic are fixed-time and vehicle-actuated traffic signals, "Stop"



5

PARKING & TURN RESTRICTIONS

LEGEND

- NO PARKING ANY TIME
- NO PARKING, 7AM.–9 AM.
- NO PARKING, 4 PM.–6 PM.
- NO PARKING, 7AM.–9 AM. 4 PM.–6 PM.
- NO LEFT TURN, 4 PM.–6 PM.
- NO LEFT TURN, 7AM.–9 AM. 4 PM.–6 PM.

NORTH

0 1 2 3 4 5 6

MAP SCALE IN THOUSANDS OF FEET

BERKELEY TRAFFICWAYS

Wilbur Smith and Associates

6

TRAFFIC CONTROLS

<u>LEGEND</u>

- SIGNALIZED INTERSECTION
- YIELD SIGN
- STOP SIGN

NORTH

0 1 2 3 4 5 6

MAP SCALE IN THOUSANDS OF FEET

BERKELEY TRAFFICWAYS

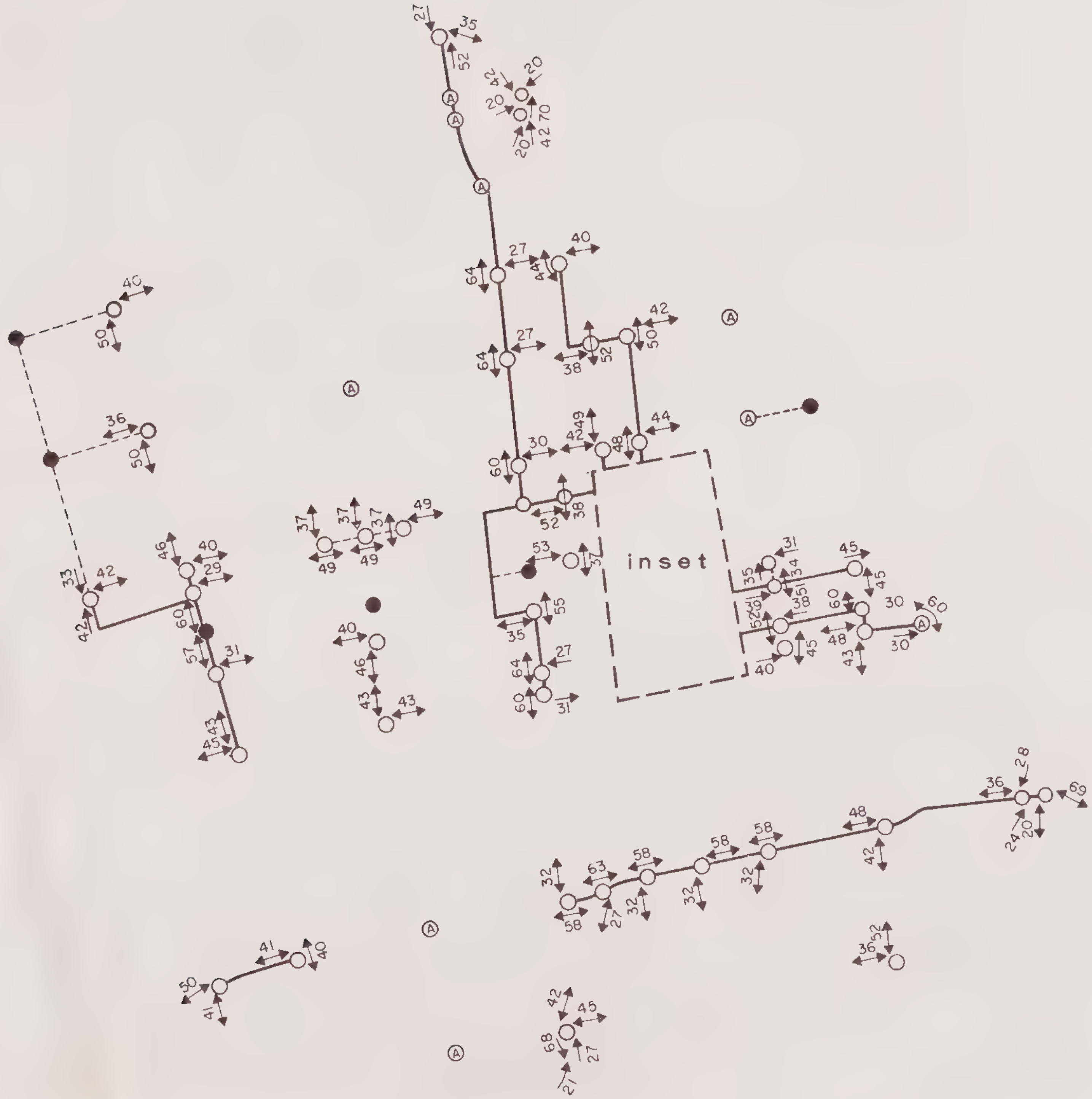
Wilbur Smith and Associates

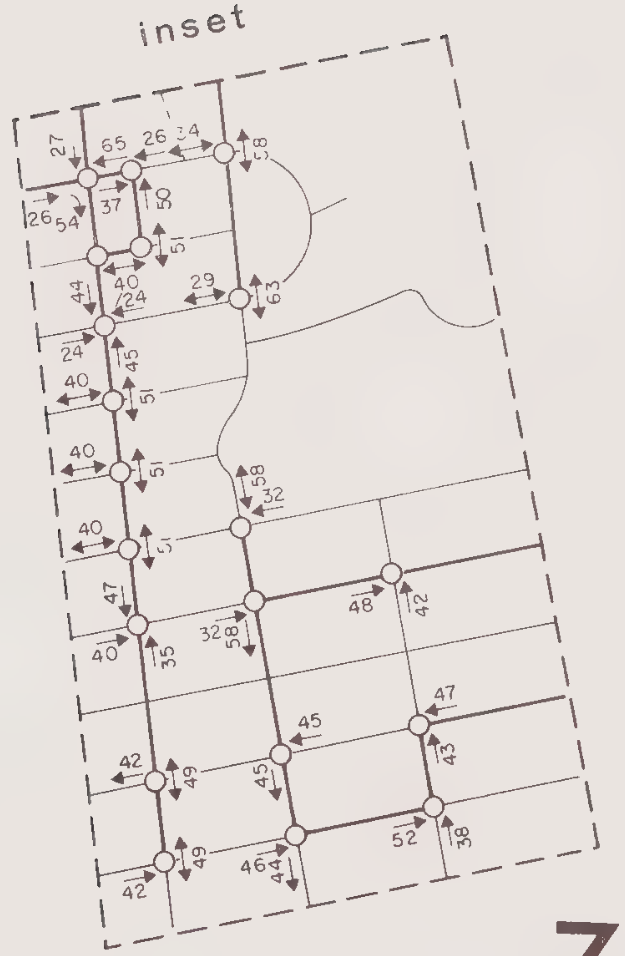
and "Yield" signs as well as pavement markings, parking restriction signs and one-way direction signs. The speed limits in effect within the city are 25 miles per hour on all streets, with the exception of San Pablo Avenue and Sacramento Street, where the limits are 35 and 30 m.p.h., respectively. Some portions of the east frontage road (Eastshore Freeway) have limits of 40 miles per hour.

Traffic Signals -- Traffic signals are located at 76 intersections within the City of Berkeley, and three new installations are proposed for early construction. The locations of these, as well as the electrical interconnection systems and signal timings in use, are illustrated in Figure 7. At present seven of the existing intersections are subject to vehicle actuation; the remaining, pre-timed control installations provide for progressive signal timings on the other arterial streets.

"Stop" and "Yield" Signs -- In addition to the signal-controlled intersections, crossing and turning movements from intersecting minor streets at arterial streets are controlled by use of "Stop" signs. Such signs are also used to establish right-of-way priorities at unsignalized intersections of arterial streets. Similar use of "Yield" signs has been made on secondary or collector streets. The location of these signs is also shown in Figure 6.

Pavement Markings -- The streets in the City of Berkeley are marked with center lines, traffic lane lines, parking stalls, crosswalks, and turning lane provisions. Curb use regulations are indicated by colors conforming to State of California standard paint markings. While channelization at the relatively large number of oblique arterial intersections is usually well indicated by pavement markings, a few of these intersections, in particular the Adeline-Stanford-61st Street intersection at the Oakland city limit require more detailed treatment.





7

TRAFFIC SIGNAL INTERCONNECTION AND TIMING

LEGEND

- 45 PERCENT OF SIGNAL GREEN TIME*
- EXISTING TRAFFIC SIGNAL
- PROPOSED TRAFFIC SIGNAL**
- EXISTING INTERCONNECT CABLE
- PROPOSED INTERCONNECT CABLE
- (A) VEHICLE ACTUATED SIGNAL

*Does not include percent of yellow

**Planned by City of Berkeley for early implementation

NORTH

0 1 2 3 4 5 6

MAP SCALE IN THOUSANDS OF FEET

BERKELEY TRAFFICWAYS

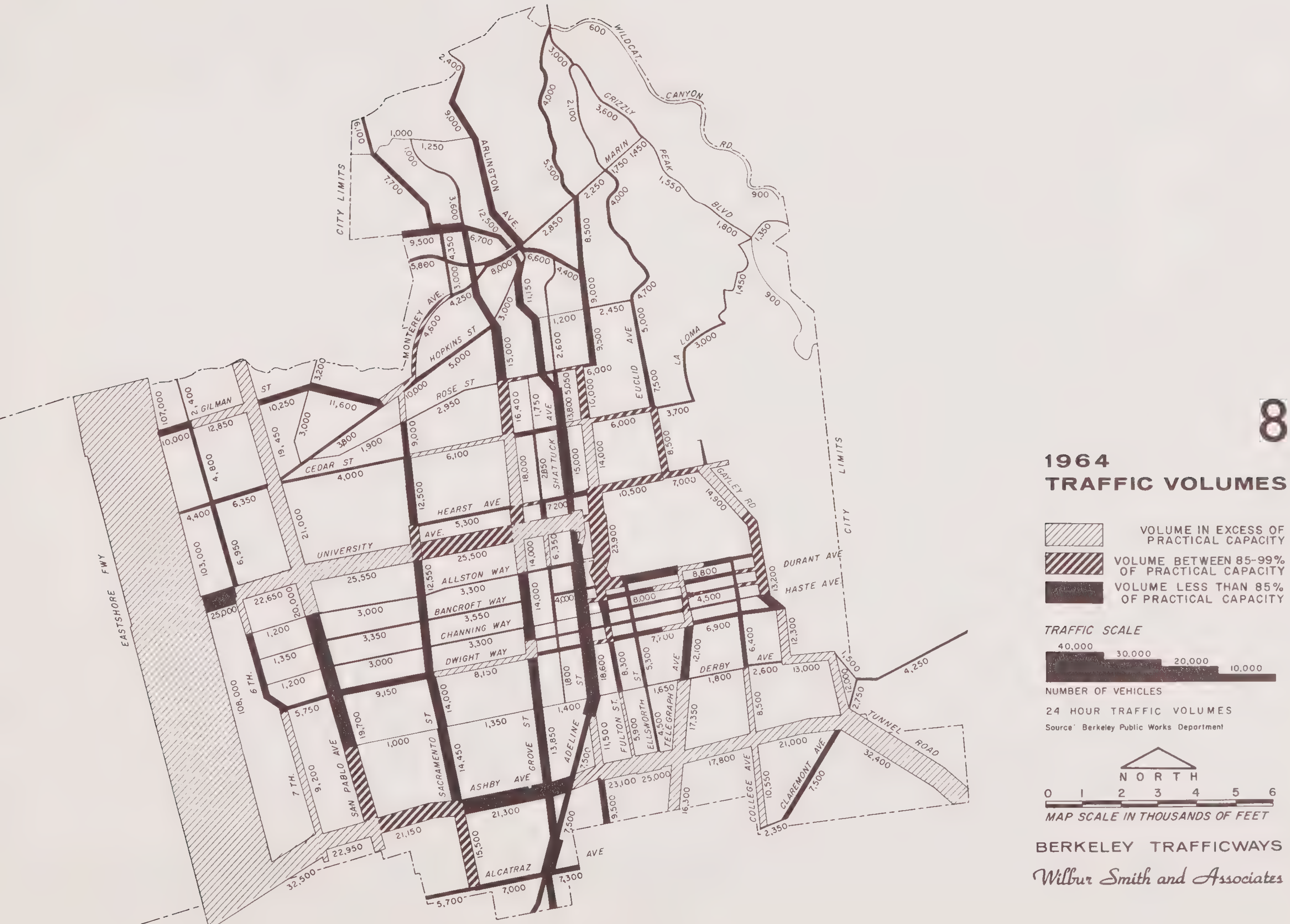
Wilbur Smith and Associates

III TRAFFIC CHARACTERISTICS

Analysis and evaluation of the existing traffic characteristics and travel patterns, discussed in this chapter, provide insight into the capability of the present system of streets and highways to meet the demands imposed upon it. The improvements required to handle future demands may be planned by relating the existing supply-demand characteristics to the expected increases in traffic occasioned by growth of the area.

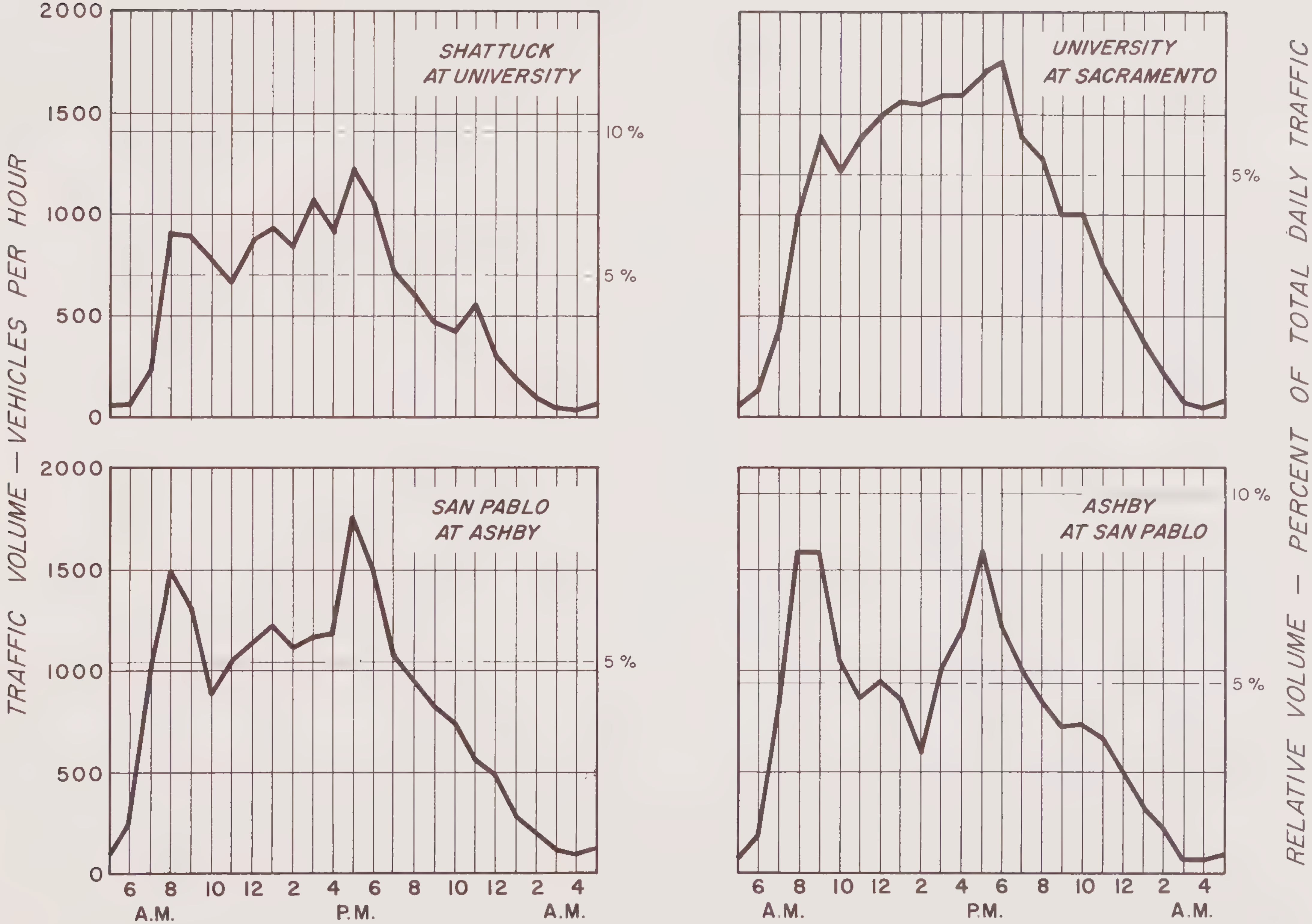
Traffic Volumes

Average daily traffic volumes on the major street system in Berkeley during 1964 are shown in Figure 8. As may be seen, the heaviest daily volumes are on University Avenue, Ashby Avenue, San Pablo Avenue, and on Shattuck Avenue, the major commercial north-south artery. Other streets with above average volumes include Telegraph Avenue, Oxford Street, and the Alameda-Grove Street complex. The hourly variation in traffic on four selected streets for two typical weekdays is shown in Figure 9. For the two north-south streets examined, Shattuck and San Pablo, it was found that the evening peak-hour traffic, between 4 and 5 P. M., represented the highest demand upon the street -- 8.8 and 8.5 percent, respectively, of the combined daily approach volumes. The morning peak hour, 7-8 A. M., was less significant, accounting for 6.5 and 7.3 percent, respectively, of the total 24-hour period approach volumes. For the two east-west streets, University and Ashby, the morning peak-hour occurred somewhat later -- from 8-9 A. M. -- when peak-hour volume percentages of 6.0 and 8.4, respectively, were found. The evening peak hour on University occurred between 5-6 P. M. and represented approximately 7.4 percent of the daily volume; on Ashby the peak hour volume (4-5 P. M.) was 8.3 percent. This low peak-hour percentage is indicative of the high degree of local activity throughout the day in proportion to the longer distance work trips which usually produce



8

1964 TRAFFIC VOLUMES



HOURLY TRAFFIC VARIATION

Combined Approach Selected Streets

peak-hour percentages in the range of 10 to 15 percent. The relatively constant volume on University in particular gives some indication of the importance of this street, not only as an arterial, but also as a commercial terminal point all day long.

Traffic Capacity

As used in this report, the term "capacity" refers to the practical number of vehicles that can normally pass a given point without traffic densities becoming so great as to cause unreasonable delay, hazard, or restriction to the drivers' freedom to maneuver. Although a street may actually accommodate traffic volumes in excess of its practical capacity, operating characteristics will be less desirable under such conditions; lower speeds, frequent delays, and increased accident rates can be expected.

Freeways have very high capacities because, with direct crossings and side interferences eliminated, traffic is essentially free-flowing. Capacities of surface arteries are considerably lower with intersections, conflicts with pedestrian movements, and the influence of curb parking all working to restrict the vehicular flow. However, in the case of certain terminal streets in the central business district or near the University, for example, city policy might properly place more emphasis on facilitating pedestrian movement than on providing vehicular capacity. To the degree that such policy would reduce needed capacity for vehicles, compensating street improvements would be required such as additional lanes for vehicles or introduction of one-way traffic patterns.

Table 1 indicates practical capacities of typical roadway sections.

At present, traffic volumes on a number of streets in Berkeley are in excess of practical capacity. In Figure 7 these over-capacity locations are indicated by contrasting color. Some of the most important streets in the Berkeley arterial system are overloaded -- University Avenue, Grove Street, Ashby Avenue. These streets require improvement immediately, and this need will increase as traffic volumes

Table 1

PRACTICAL CAPACITIES OF TYPICAL ROADWAYS
Berkeley Trafficways Study

ROADWAY TYPE	TOTAL VEHICLES IN BOTH DIRECTIONS	
	Peak Hour	24 Hours
8-Lane Freeway	8,000-10,000	80,000-100,000
6-Lane Freeway	6,000- 7,500	60,000- 75,000
6-Lane Expressway	3,000- 5,300	30,000- 53,000
6-Lane Arterial (88 ft. incl. parking)	2,200- 2,700	25,000- 30,000
6-Lane Divided Arterial (72 ft. no parking)	3,200- 3,700	32,000- 37,000
4-Lane Divided Arterial (2 32-ft. roadways incl. parking)	1,750- 2,250	17,500- 22,500
4-Lane Divided Arterial (48 ft. no parking)	2,000- 2,400	20,000- 25,000
4-Lane Arterial (64 ft. including parking)	1,500- 2,000	17,000- 22,000
4-Lane Major Business St. (64 ft. incl. parking)	1,200- 1,500	13,000- 17,000
4-Lane Arterial (56 ft. including parking)	1,250- 1,600	14,000- 18,000
4-Lane Major Business St. (56 ft. including parking)	900- 1,350	10,000- 15,000
2-Lane Arterial (40 ft. parking)	800- 1,200	9,000- 13,000
3-Lane One-Way Arterial (44 ft. parking one side)	1,600- 2,400	17,000- 25,000
2-Lane One-Way Arterial (40 ft. parking)	1,100- 1,600	12,000- 18,000

Note: Motor vehicle traffic capacities based on Highway Research Board Capacity Manual, with upward adjustments based on subsequent research. Freeway capacities based on "A Policy on Arterial Highways in Urban Areas," American Association of State Highway Officials. Calculations based on 60 percent green signal period, 10 percent trucks, 20 percent combined left and right hand turns, one direction volume two-thirds of other in peak hour, and 9 to 10 percent peak-hour relation to 24-hour volume.

grow. A complete summary of volume-capacity relationships are shown in Appendix A-1.

Accident Experience

Traffic accidents on Berkeley streets constitute a waste, both of money and human resources. Accidents are costly evidence of inefficiency and inadequacies of certain streets and highways. While it is impossible to eliminate automobile accidents entirely, improved efficiency of traffic control can substantially reduce their frequency.

The pattern of recorded vehicular accidents on the Berkeley major street system, illustrated in Figure 10, sheds an interesting side-light on the volume-capacity relationships shown in Figure 8. On this map the traffic accident history during the year 1963 is shown in graphic form. This spot map is intended to show relative incidence of accidents rather than actual numbers. Specific details are contained in the files of the Berkeley Police Department. While the total numbers of accidents occurring on a street or at an intersection is important, a more significant measure is the relationship between the number of accidents and the volume of traffic; viz., the number of accidents per million vehicle miles. In Table 2 the personal injury accident rates for a number of selected street segments are shown.

The National Committee on Urban Transportation has prepared a guide[1] of tolerable accident rates against which the Berkeley accident experiences may be compared. These rates are noted in Table 3.

Comparison of the accident rates found in Berkeley with the "standards" in Table 3 makes it clear that only a few of the major trafficways in Berkeley have "tolerable" accident rates. Of the 23

[1] Standards for Street Facilities and Services, Public Administration Service, 1958.

10

1963
TRAFFIC ACCIDENTS

LEGEND

- ○ ---------- PROPERTY DAMAGE
- ● ---------- PERSONAL INJURY
- ✕ ---------- FATALITY

Source: City of Berkeley Police Department

NORTH

0 1 2 3 4 5 6

MAP SCALE IN THOUSANDS OF FEET

BERKELEY TRAFFICWAYS

Wilbur Smith and Associates

Table 2

1963 INJURY ACCIDENT RATES, SELECTED TRAFFICWAYS
Berkeley Trafficways Study

STREET	LIMITS	CRUDE RATE[a]	ADJUSTED RATE[b]
Solano	City Limit - The Alameda	0	0
Dwight Way	7th - Grove	189	65
Oxford	Rose - Bancroft	108	92
Grove - The Alameda	Solano - University	112	103
Hopkins	San Pablo - Sutter	274	137
Shattuck	Rose - University	178	148
Shattuck	University - Ashby	327	177
Cedar	6th - La Loma	335	189
Ashby - Tunnel Rd.	7th - East City Limit	224	191
University	6th - Oxford	267	192
Dwight Way	Grove - Piedmont	338	203
San Pablo	City Limit - City Limit	260	205
Grove	University - Adeline	293	205
Sacramento	Hopkins - Alcatraz	289	215
Gilman	6th - Hopkins	339	218
Telegraph	Bancroft - Woolsey	387	288
Fulton	Bancroft - Ashby	515	312
College	Alcatraz - Bancroft	385	314
Ellsworth	Ashby - Bancroft	792	366
Shattuck - Adeline	Ashby - Alcatraz	508	397
Shattuck	Adeline - City Limit	557	405
Euclid	Hearst - Marin	408	408
Haste	Piedmont - Grove	888	428

[a] Crude rate based on all accidents associated with a given section of street. Rate indicates number of injury accidents per 100-million vehicle miles of travel. [b] Adjusted rate based on a distribution of major street intersection accidents proportional to traffic volumes. Rate indicates number of injury accidents per 100-million vehicle miles of travel.

Table 3

TOLERABLE INJURY ACCIDENT RATES, FOR TYPICAL ROADWAY TYPES
Berkeley Trafficways Study

ROADWAY TYPE	INJURY ACCIDENT RATE[a] (per 100 million vehicle miles)
Expressways	
Full control of access	50 - 60
Partial control	60 - 100
Major Streets	
Divided	75 - 150
Undivided	100 - 200
Collector Streets	60 - 80
Local Streets	
Business	5 - 20
Industrial	1 - 20
Residential	0.5 - 10

[a] Injury accidents include all fatal and non-fatal injuries.

Source: National Committee on Urban Transportation.

sections of street examined, only 5 have rates which fall within the acceptable range, and on these there is reason to believe that the low accident rates are achieved by compromises in operating characteristics rather than by the excellence of the street. Only one street (Shattuck Avenue, between Rose and University) combines a favorable accident record with a reasonably adequate operating speed. On the other four, travel speeds are substantially below those expected for streets of this type. These are Solano Avenue, Dwight Way and Grove and Oxford Streets.

Travel Speeds

The primary function of trafficways should be the safe, rapid transport of people and goods from one point to another. In our present culture the measure of separation between points is often expressed in terms of time rather than distance. An increase in speed brings two points closer together; a reduction in speed by congestion effectively increases their separation. Thus the evaluation of travel speeds on a city's trafficways is important. Automobile speed studies on trafficways within the City of Berkeley were conducted on typical May, 1964 weekdays during off-peak periods of traffic. A test vehicle was driven to match the speed of other vehicles in the stream of traffic to duplicate, as accurately as possible, the operating speeds associated with each street segment. Several runs were made in each direction of travel to ensure that the observed driving times were representative, and were then averaged to ascertain the average off-peak travel time and speed.

Average speeds were found to vary from a high of 30.2 m.p.h. on one portion of Hopkins Street to a low of 9.5 m.p.h. on Dwight Way, west of Sacramento. The general ranges of operating speeds observed are shown in Figure 11. Reference to Figures 8 and 10 illustrates the interrelated effects of the use of streets at volumes over their capacity. It is apparent that those streets which are operating at above-capacity volumes are characterized by both high accident rates and low operating speeds. In addition to the normally expected delays experienced at traffic signals and stop signs, the major

11

TYPICAL TRAVEL SPEEDS
OFF-PEAK, AVERAGE WEEKDAY

LEGEND

- ---------30 MPH. & ABOVE
- --------------25 MPH.
- --------------20 MPH.
- ----------------15 MPH.
- ---------10 MPH. & BELOW

NORTH

0 1 2 3 4 5 6

MAP SCALE IN THOUSANDS OF FEET

BERKELEY TRAFFICWAYS

Wilbur Smith and Associates

causes of delay were attributable to turning vehicles and the maneuvering of vehicles from curb space used for angle parking. Many of Berkeley's trafficways allow for only one moving lane in each direction; a left-turning vehicle, stopped at the head of a column of cars, effectively blocks all movement in that direction until it is able to proceed. A high degree of improvement of this situation may be achieved, however, by simple traffic engineering methods. Angle parking on major trafficways presents a formidable problem also, because of the unparking maneuver which blocks traffic. There is a constant hazard attached to unparking a car, because through traffic has right-of-way and the sight distance of the unparking driver is usually obscured. A further complication is the use of angle parking spaces by trucks (see photo below),

which because of their greater length block the outside moving lane. This is an extreme example of the deleterious effects of angle parking on the capacity of a major trafficway.

Arterial Sufficiency Rating Analysis

In order to provide a scale by means of which elements of the trafficways system can be compared with some degree of equity, a system of sufficiency ratings was devised. It is based upon one developed cooperatively in the cities of Phoenix, Arizona, and Nashville, Tennessee[2]. With the help of the Public Works Department staff, and reflecting their intimate knowledge of local conditions, modifications have been introduced here to fit the Berkeley area. The rating procedure evaluates four basic elements of the many characteristics of an arterial street: travel delays, safety record, structural condition, and traffic service.

The rating formula used for this study is as follows:

Element	Relative Weight (points)
Delay rate per mile	50
Collision Index - Accidents/mile ÷ Accident rate/mile	15
Structural Condition	15
Traffic Needs $= \dfrac{\text{Present ADT}^a}{1,500} + \dfrac{\text{Future ADT}^a}{2\ (\text{Present ADT})}$	20
Maximum Possible	100

[a] ADT = average daily traffic.

The formula, in which the higher the numerical score the greater is the need for improvement, gives greater weight to existing conditions than to future requirements. This is so because of the

[2] Urban Street Programming - The Use of a Priority Formula, E. M. Hall & C. D. Hixon; presented at Highway Research Board, Annual Meeting, Jan., 1964.

need to make the comparisons as factual and as objective as possible. In essence what is expected from such an analysis is a relative ranking of the needs for improvement; the actual scheduling and budgeting of these improvements is and should be a matter of judgement -- both technical and administrative. However, the mathematical approach, which is described above, provides an objective classification, and will eliminate the need to rely solely on personal evaluation.

Appendix Table A and Figure B summarize the ratings of trafficways in Berkeley resulting from this sufficiency analysis.

This analysis gives some insight into the problems associated with the Berkeley trafficways system. In the quartile with the highest scores (those most in need of action) are parts of San Pablo Avenue, Grove Street, Shattuck Avenue, Fulton Street, University Avenue, and Ashby Avenue. These streets all received high numerical ratings in the traffic section of the rating procedure, averaging 14 points of a possible 20. The other noteworthy deficiency on these streets was delay; the scores for this part averaged 28 points of a possible 50. The average of collision points was 11 of 15 (nine segments had the maximum possible), and the average of structural points was 10 of 15.

Of the major streets carrying significant volumes of traffic only a few were included in the lowest quartile. Cedar (Sacramento to Grove and Spruce to La Loma), Dwight Way (Sacramento to Grove), the Warring-Derby-Belrose-Claremont route, Claremont Avenue, The Alameda, and Sutter (north of Rose) fell into this grouping. Many of these streets, however, have problems which are not revealed in the rating process. Peak-hour traffic, for example, may present delay characteristics considerably different than off-peak traffic. While the time of delay measurement does effect the ranking for some of the low-score streets indicated above, the use of off-peak data ensures the inclusion of the most seriously deficient street segments. If deficient during off-peak periods, a street will surely be deficient during periods of heavy traffic.

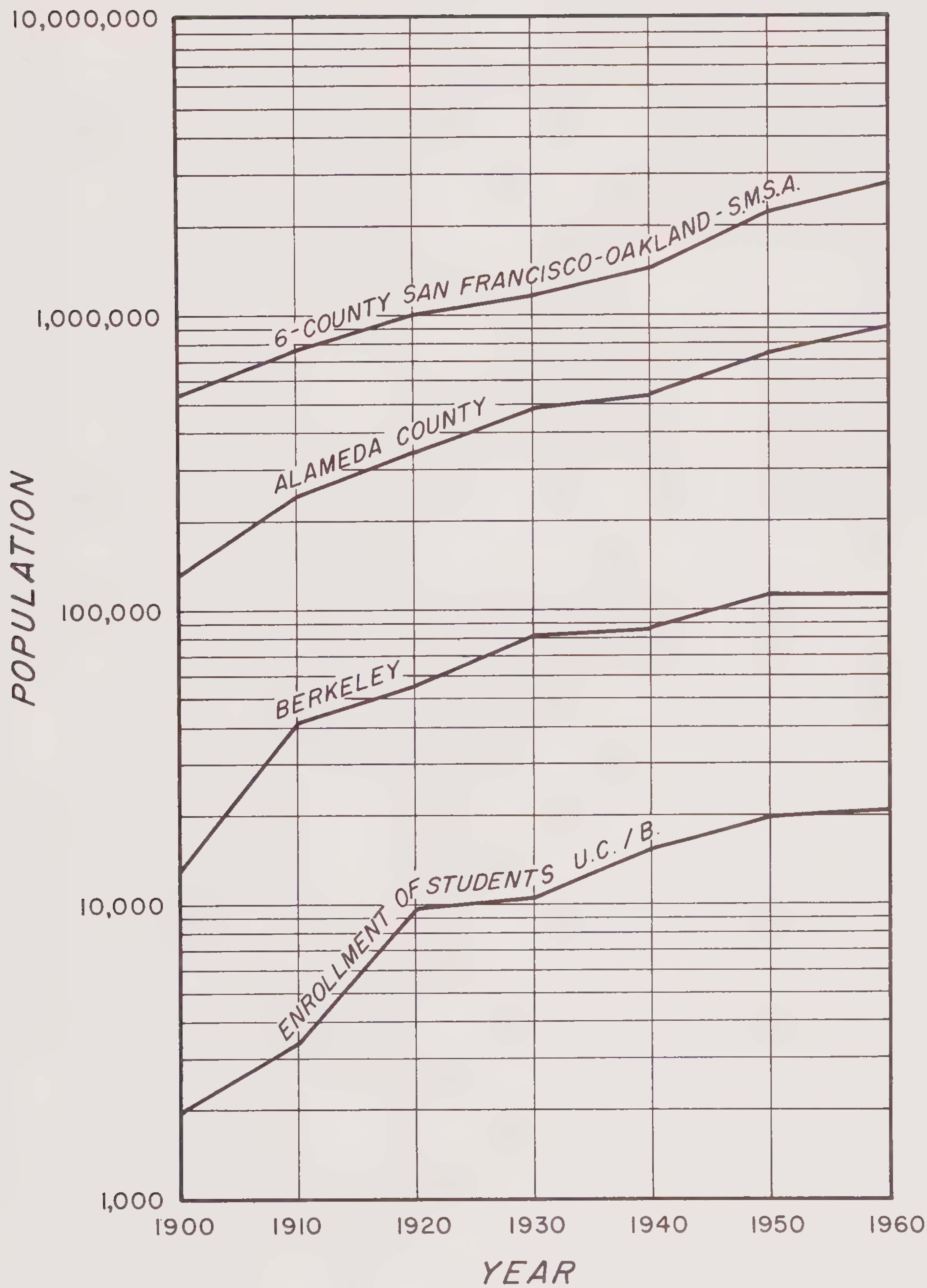
Traffic Growth

Berkeley is now a mature city. Essentially all of the readily developable land has been utilized; rapid growth by lateral expansion has, for all practical purposes, ceased. The future increase in the population and economic activity -- and thus, by extension, of traffic demands -- must parallel the redevelopment of existing properties, replacing inefficient commercial uses with modern facilities and low density land uses with higher density developments. This redevelopment will be of two general forms -- public or private -- and will range from mass development to individual lot improvement. Some of the factors of growth are examined below in relation to their impact on the trafficways system.

Population Growth -- At the time of the preparation of the highway plan for Alameda County[3] it was estimated that the population of the Berkeley-Albany area would increase from approximately 136,400 (1958) to 153,700 (1980). The planning officials of the two cities now indicate that a combined population of 142,000 would be a more realistic estimate of the 1980 population. Thus the increase now expected is roughly 30 percent of that projected earlier. Berkeley itself is expected to increase from a 1960 population of 111,268 to approximately 130,500 by 1980.[4] See Figure 12.

It is anticipated that the great bulk of this growth will occur through an increased density in areas which are now developed. An example of this trend is found in the South Campus area where the construction of several new dormitory complexes by the University and the replacement of obsolete single family structures by high-density apartment buildings is still in process. To a lesser degree, a similar evolution is expected to occur in the area on the north side of the campus as well as in two broad areas of medium- to high-density zoning west of Adeline and centered along Ashby Avenue.

3 Alameda County Highway Master Plan, prepared for County of Alameda by Wilbur Smith & Assoc., 1959.
4 Source: Berkeley City Planning Department.



12
POPULATION TRENDS

Although no data are available regarding the specific measure of impact of the Rapid Transit stations on residential densities, it may well be anticipated that this new urban element will induce higher density uses in areas surrounding the stations.

University of California -- Enrollment for the 1964 Fall Semester at the U. C. Berkeley campus reached the 27,500 level established as the maximum under the California Master Plan for Higher Education[5]. It is now expected that no further growth in student enrollment will take place at the University. Planned growth, however, will continue. University-associated employment, both in the teaching faculty and in the various research centers, is expected to grow from 9,350 in 1960 to 12,500 persons by 1980.[6]

Employment -- The State Department of Employment estimate of the number of jobs in the Berkeley-Albany area in July, 1962 was 57,900, compared to 45,400 for the corresponding month in 1959.[7] Of the total increase of 12,500 jobs, 9,500 were in the field of government, which would include the University of California as well as city, state and federal employment centers. The University has estimated that an additional 3,000 employees will be added at the ultimate level of development. With service employment the only other category showing an increase, it may be estimated that a total 1980 employment of from 60,000-65,000 may be anticipated in the two cities by 1980.

Automobile Ownership -- In the Berkeley area one of the most significant factors in the urban traffic increase is the relationship between car ownership and trip production. As the vehicle ownership rate increases, more trips per household are produced.[8] Thus it may be expected that even an area which is stable as far as population growth is concerned will show an increase in trip production with

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[5] A Master Plan for Higher Education in 1960-1975, California State Department of Education, Sacramento, 1960.

[6] Source: Riches Research, Inc.

[7] Community Labor Market Surveys, State Department of Employment, 1962.

[8] Future Highways & Urban Growth, prepared for Automobile Manufacturers Association, Wilbur Smith and Assoc., 1961, p. 77.

increasing automobile ownership. In 1962 it is estimated that the ownership ratio of Berkeley was approximately that of Alameda County -- 0.45 cars per person. On the basis of estimates made by the California Division of Highways, a ratio of 0.50 cars per person may be expected in 1980. This ratio, which would result in a total Berkeley auto population of 65,250 cars, appears to be conservative in that it assumes the ownership rate of University students to be equal to the rest of the city's population and thus offers a planning figure approaching the outside limit of growth.

Traffic Growth Projections -- Table 4 summarizes the projected growth of the principal factors affecting auto traffic. On the basis of these estimated incremental increases, an overall increase of from 10 to 20 percent between 1963 and 1980 appears to be realistic. To ensure that future volumes will not be understated, the higher value has been selected for use in this trafficways study.

Table 4

TRAFFIC GROWTH FACTOR ESTIMATES
Berkeley Trafficways Study

ITEM	ANNUAL TOTALS			GROWTH	
	1960	1963	1980	1960-80	1963-80
Population	111,268	120,000[a]	130,500	1.17	1.09
University of California					
Enrollment	21,860	27,500	27,500	1.26	1.00
Employment	9,350	9,500[a]	12,500	1.34	1.32
Employment, Other	34,650	48,500[a]	50,000[a]	1.44	1.03
Autos	46,300[a]	52,200	65,250	1.41	1.25

[a] Wilbur Smith and Associates estimate.

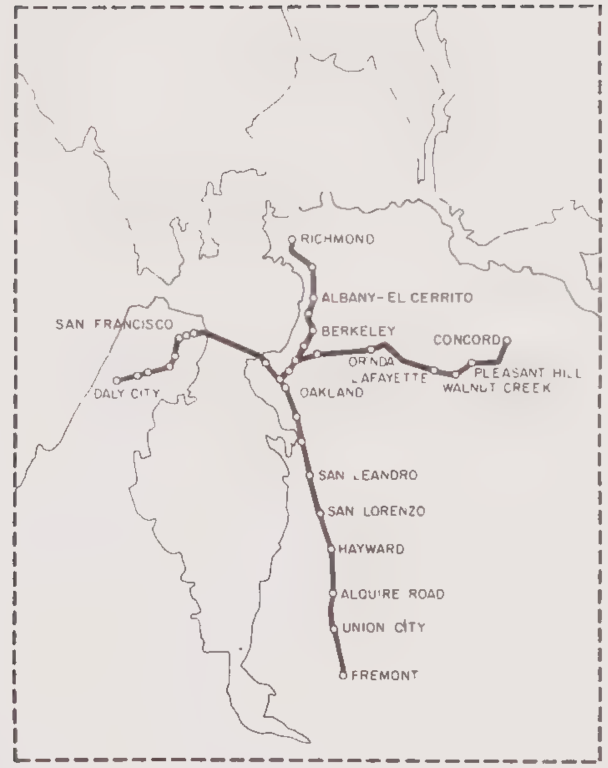
IV PUBLIC TRANSIT PLAN

The dense urban development of Berkeley, major traffic generators such as the University of California campus, and the economic interaction between Berkeley and other nearby major centers such as Oakland and San Francisco are factors which make the utilization of public transit an important part of the total transportation system of the city. As indicated earlier, Berkeley is now well served by the buses of the Alameda-Contra Costa Transit District; planned developments will further increase the degree of transit service. In this chapter the proposed public transit changes are briefly discussed and their impact on the total transportation system examined.

Future Rapid Transit

The development of the Bay Area Rapid Transit system, connecting San Francisco, Oakland, Berkeley, Richmond, Concord, Hayward and Fremont with a high-speed rail network is undoubtedly one of the most ambitious undertakings in recent urban history. Construction of this billion dollar system began in June, 1964. By 1967 service on the Richmond-Hayward segment is expected to be in operation, and by 1968 or '69 the Trans-Bay connection between Oakland and San Francisco will be included. By the end of 1972 the system should be complete. Figure 13 illustrates the Rapid Transit System routes.

Plans for the development call for the use of modern high-speed, automated trains, running on exclusive rights-of-way. Cars are being designed specifically for this system, utilizing a wider than normal track gauge for greater stability and comfort. Although scheduling of the trains is, of course, still only general in nature, the announced plans of the district indicate that headways of from 2 to 3 minutes during peak hours and approximately 15 minutes during off-peak periods may be expected. Train design and scheduling are being based on a design average speed of from 45-50 miles per hour which will be attained with equipment capable of accelerating to speeds of up to 70 to 80 miles per



13

RAPID TRANSIT ROUTE

LEGEND

- SURFACE OR ELEVATED
- SUBWAY
- STATION
- PARKING AREA

NORTH

0 1 2 3 4 5 6

MAP SCALE IN THOUSANDS OF FEET

BERKELEY TRAFFICWAYS

Wilbur Smith and Associates

hour or more between stations.

Within Berkeley the transit facility will take one of two forms; depending upon the type of area through which it passes, it will be either elevated, or below grade in a covered (subway) tunnel. While a number of details remain to be worked out, present plans probably represent a good general picture of the rapid transit facility. The rail lines will enter the city from the south on aerial structures in the median of a widened Grove Street. At Alcatraz Avenue the lines will merge with Adeline Street, where they will continue elevated within the street right-of-way. At Ashby Avenue, where the first major station within Berkeley is proposed, the passenger loading area will be reached by stairs connecting with a pedestrian mezzanine spanning Adeline St.. In addition to two parking lots designed to serve the station with a combined capacity of approximately 850 cars, exclusive surface bus lanes at the station site are presently proposed to facilitate operation of the bus feeder system.

Just north of the intersection with Shattuck Avenue, a transition from aerial to underground design is planned. Allowing approximately 900 feet for this transition, the tracks will be in a subway at a point just south of Dwight Way. A second station (now called the "Berkeley" station) will be located at Allston Way, two blocks south of University Avenue. Passengers will proceed to their trains at this point by way of a pedestrian mezzanine constructed below the surface of existing West Shattuck Avenue and over the transit tracks. No area has been planned for the parking or storage of private passenger vehicles at this station.

North of University Avenue, the line swings to the west to run north of and parallel to Hearst Street. Between Milvia Street and Grove the tracks will emerge from the subway section and will again be elevated. Plans have been prepared indicating the possibility of widening this part of Hearst on the north side to provide two 32-foot roadways with the transit structure located within a 12-foot

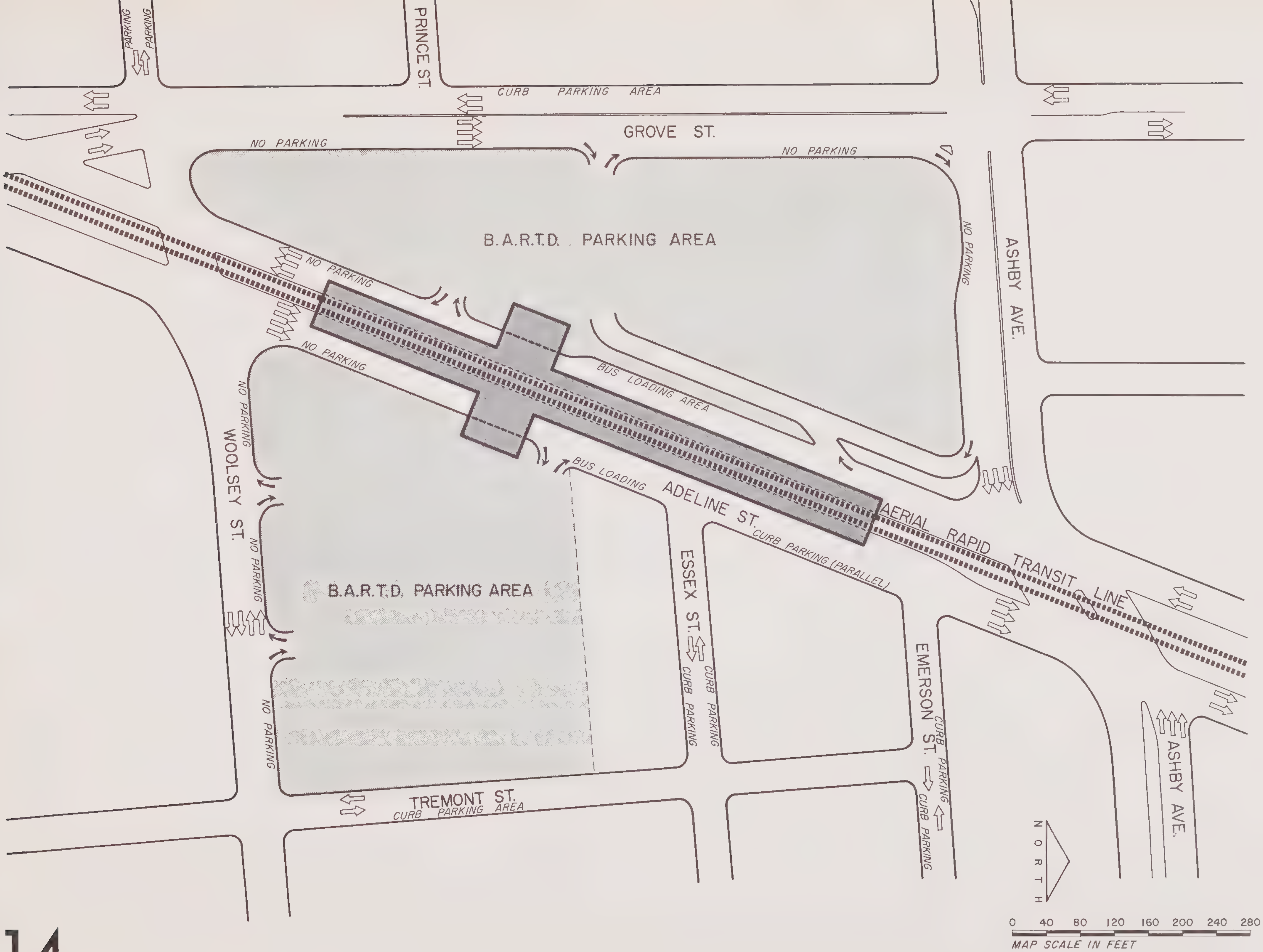
median. Between California Street and Sacramento Street the line would again swing to the northwest to follow the A.T. & S.F. R.R. right-of-way to Richmond. The third and remaining Berkeley station is planned at Sacramento and Delaware Streets. As with the Ashby Avenue station, parking lots would be developed as an integral part of this station; 1,100 spaces are indicated.

Functional Design of Roadways

In Figures 14, 15, and 16, plans for the functional design of the roadways adjacent to the three rapid transit stations are shown. It should be noted that the designs shown are not necessarily the only possible solutions to the problem of providing adequate traffic capacity and storage of buses and parked cars. They do, however, indicate feasible solutions which have been reviewed by both the Transit District's engineers and by the staff of the City of Berkeley.

Ashby Station -- Figure 14 illustrates the streets adjacent to the Ashby Avenue station complex. Ashby Avenue itself is to be widened to six lanes with a non-traversible median divider.[1] To facilitate right-turning vehicles from Ashby (eastbound) to Adeline, a separate turning lane is provided. Adeline is also a six-lane street with additional widening for curb bus stops near the station entrances. All "kiss and ride" (term employed where the wife drives the family car to and from the transit station to deliver or pick up her husband) stopping and pick-up parking is to be handled in designated areas in the BARTD parking areas. This should obviate the need for curb parking facilities for rapid transit patrons. A small number of curb parking spaces will be available along the east side of Adeline to serve the businesses located there. Access to the BARTD parking area between Adeline and Tremont is limited to Adeline and Woolsey Streets; access from Adeline is located near the northerly end of the facility. Grove is to be widened to provide more capacity. A dual roadway section has been recommended having two moving and one parking lanes (southbound) and

1 The widening of Ashby Ave. and Grove St. is discussed in more detail in the following chapter.

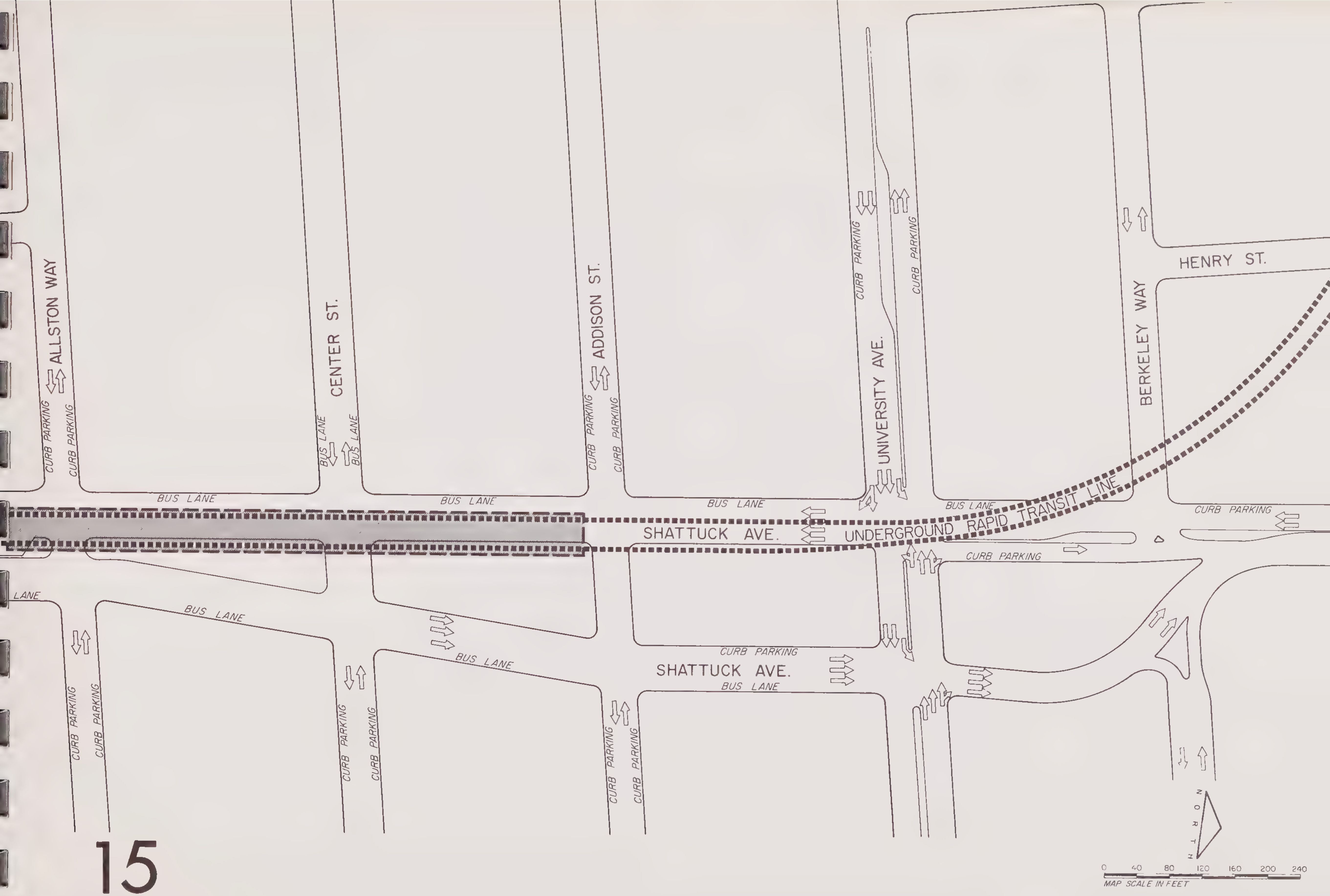


14

FUNCTIONAL DESIGN ASHBY AVE. STATION

BERKELEY TRAFFICWAYS

Wilbur Smith and Associates



15

FUNCTIONAL DESIGN - BERKELEY STATION

BERKELEY TRAFFICWAYS

Wilbur Smith and Associates

16

FUNCTIONAL DESIGN - SACRAMENTO ST. STATION

BERKELEY TRAFFICWAYS
Wilbur Smith and Associates

three moving lanes on the northbound side, separated by a three-foot median which would prevent mid-block turning conflicts. A separate right-turning lane is provided from Grove to Ashby Ave..

Berkeley Station -- Because the downtown station has no special parking or auto passenger pick-up or deposit areas delineated, all activity of this nature must be accommodated within the streets themselves. For this reason the streets of the CBD will be called upon to meet the demands for the normal through and local traffic, bus operation, parking, and auto and taxi usage associated with the rapid transit station. They must, of course, also provide adequate cross-walk capacity for the heavy pedestrian movements which will be generated both by the transit station and the businesses and offices in the area. In a number of areas these demands are incompatible and so some uses must be given priority over others.

In Figure 15 a functional plan for the downtown station area is illustrated. Each of the Shattuck Avenue roadways is shown as a 44-foot section. This will allow for three moving lanes plus a bus loading/parking lane. During off-peak hours it may be possible, in some few locations, to tolerate parking on both sides of the street.

Until the number, location and types of entrances to the station are finally determined, further detailing of the paving for Shattuck Avenue would be pointless. These questions are being discussed now by the City and the Transit District; upon the determination of these points more precise planning of the street can be accomplished.

The planned widening of University Avenue and the proposed extension of "East" Shattuck northward[2] should eliminate many of the problems now found at this intersection. Additional widening should be provided on Allston Way to bring this street up to standard. A 40-foot section will still allow adequate sidewalk area for pedestrian movements.

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[2] See Chapter V for a full discussion of these improvements.

Special attention should be given to the delineation of loading zones at the curbs in these areas to ensure that truck parking is adequate to meet the demand. No alleys are present to accommodate these functions and curbs will be very busy during both the morning and evening peak hours; therefore, it may be desirable to restrict loading operations to off-peak periods.

Sacramento Station -- As the parking demands at this station will require more area than is available on the surface of the site, a partial deck for parking has been planned for this site. The upper level of parking, occupying the eastern third of the site, would be reserved for short-term parking and for "kiss & ride" parking. Access to the parking areas from Sacramento Street would not be provided; all entrances and exits would be located on Delaware, Virginia, and Acton Streets. To eliminate conflicting mid-block movements near station entrances, Short and Francisco Streets would be closed by cul-de-sac treatment.

It is recommended that Acton Street be widened to a 40-foot cross-section with a storage lane for right-turning vehicles at the parking lot entrance. Virginia should be widened from the present 38-foot section to 48 feet, again with storage lanes as indicated. Delaware should be widened to give divided two-lane roadways with a left-turn bay to allow east-bound vehicles to enter the short-term parking area. No major changes to Sacramento Street will be necessary.

As shown in the drawing, access to the station by bus will be quite convenient. Southbound buses on Sacramento would load and unload passengers at the curb on Sacramento near Delaware; northbound buses could utilize the drive along the western edge of the parking deck to bring passengers into the station area itself, to eliminate the need for transit patrons to cross the street on foot.

Surface Transit

The construction of the Bay Area Rapid Transit system will have a marked effect on the opera-

tion of the existing bus transit system. The extent of the changes in service will depend to a large degree on decisions -- both in policy and in detail -- which have not yet been made. However, it is possible to make certain general predictions about the future bus service within Berkeley.

The introduction of rapid transit service may not completely supplant the trans-bay service afforded by ACCTD (Alameda-Contra Costa Transit District) buses. It is likely that bus service to San Francisco via the Bay Bridge will continue to be available even after the initiation of trans-bay service by BARTD in 1968-'69.

Bus feeder service to BARTD stations by ACCTD should also be expected. Whether this service would be on a single-fare transfer basis or as two separate transactions is as yet undecided. While recent pilot studies in the Boston, Massachusetts area designed to test public acceptance of bus feeder service did not indicate a high degree of public acceptance for such service[3], the unique characteristics of the proposed Bay Area system make it difficult to draw an exact parallel between the two areas.

At present approximately 15 percent of workers residing in Berkeley who travel to work use a bus to make their work trips.[4] It would seem quite unlikely that any radical shift in this pattern will take place in the near future. The combination of improved transit service and the continuing pressure for parking space in the employment centers of Berkeley, Oakland and San Francisco should work to encourage an even greater usage of public transit. Since approximately 30 percent of the labor force of Berkeley is employed in the latter two centers[5], the importance of such service is readily apparent.

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3 Demonstration Project Progress Reports, Commonwealth of Massachusetts, M.T.C., 1964.
4 U. S. Census of Population & Housing, 1960.
5 Ibid.

In addition to the effect on work trips, public transit is expected to continue to carry a significant number of persons destined to the University of California. At present about 7 percent of the students at the University commute by bus[6], while approximately 23 percent arrive by auto. Although the possible effect of the rapid transit system upon these figures is not known, there would appear to be a strong potential for shuttle service between major campus generators and the Shattuck Avenue transit line.

A study prepared by the University of California[7] contains estimates of visitation to the campus generators via rapid transit. These estimates are indicated below in Table 5.

Table 5

U. C. VISITATION VIA RAPID TRANSIT
Berkeley Trafficways Study

FROM	TO	PASSENGER TRIPS IN ONE DIRECTION Average Weekday	Peak-Hour
Berkeley Station	Main Campus	3,000	900
Berkeley Station	Radiation Laboratory	900	260
Berkeley Station	Hall of Science	250	75

From these data it would appear that there is adequate basis for the institution of feeder service between the downtown rapid transit station and the two heavier generators. The Lawrence Hall of Science could well be served by an extension of the line serving the Radiation Laboratory. These routes are shown in Figure 17.

[6] Housing & Transportation Survey, fall, 1963, University of California. [7] Short Haul Transportation on the Berkeley Campus-1970, Sept., 1963, by Wolfgang S. Homburger, Inst. of Transp. & Traffic Engin'g.

17

REVISIONS TO TRANSIT ROUTES

LEGEND

LOCAL ROUTES

SUGGESTED FEEDER ROUTES

ONE DOT EQUALS 50 PERSONS, 1980

NORTH

0 1 2 3 4 5 6

MAP SCALE IN THOUSANDS OF FEET

BERKELEY TRAFFICWAYS

Wilbur Smith and Associates

Revisions to Surface Transit Routes

It is assumed that ACCTD will institute feeder bus service to carry passengers from residential areas to the rapid transit stations. Estimates of numbers of riders arriving at each station within Berkeley have been made by Parsons, Brinkerhoff-Tudor-Bechtel, engineers for BARTD. These estimates for both average weekday and the morning peak hours are summarized in Table 6.

Table 6

TRANSPORT TO AND FROM RAPID TRANSIT STATIONS
Berkeley Trafficways Study

STATION	NUMBER OF PASSENGERS, AVERAGE WEEKDAY				
	Park Car	Kiss & Ride	Bus	Other	Total
Ashby	3,610	1,970	7,380	3,440	16;400
Berkeley	0	3,360	10,800	9,840	24,000
Sacramento	2,430	1,390	3,920	960	8,700

STATION	NUMBER OF VEHICLES LEAVING STATION, P. M. PEAK HOUR				
	Park Car	Kiss & Ride	Bus[a]	Other	Total
Ashby	456	439	21	30	946
Berkeley	0	580	26	136	742
Sacramento	402	268	11	13	694

[a] Assuming 40 passengers per bus.

The estimated demands for peak-hour bus capacity have interesting implications, both in terms of providing feeder service as a rapid transit adjunct and in the design of the rapid transit

terminal facilities themselves. Assuming an average load factor of 40 passengers per bus, approximately 58 buses would be required to handle the volumes of passengers expected to disembark from the Rapid Transit in Berkeley during the evening rush hour. While the bulk of this traffic will be carried on existing lines, some new feeder routes will be required to reach presently unserved areas or to provide more rapid service. Experience in other comprehensive transportation studies has indicated two factors which must be considered in providing feeder bus service such as envisioned here. First is an apparent resistance of riders to walk more than a relatively short distance between home or place of employment and a bus stop; second is a similar resistance to repeated changes in mode or transfers to other vehicles within a system. Feeder routes should therefore be located so as to bring bus service as close as possible to areas of housing.

In Figure 17, a suggested plan for bus lines serving the rapid transit stations has been superimposed over a map in which estimated 1980 population distributions have been shown. The basis for the suggested system has been the desire to balance a net of good service (short walking distances) with relatively short headways. No attempt, however, has been made to determine the financial feasibility of these routes.

The proposed development of the Berkeley Marina will also introduce a significant new generator into the urban transport pattern. Unlike the rapid transit stations, however, it is believed that the Marina would be adequately served by extension of existing service. At present, lines 51 and 58 end their runs westward along University Avenue at 3rd Street. When the demand for bus service is demonstrated, these lines can easily be extended to serve the Marina directly.

V THE TRAFFICWAYS PLAN

In this chapter estimates of traffic volumes anticipated in the year 1980 are discussed and a trafficways plan, adequate to accommodate the anticipated demands, proposed. Specific problems are discussed in some detail and recommendations for solution are indicated.

Objectives of the Plan

The plan of the major street system must reflect the overall planning goals of the city. A system not only efficient for movement, but also consistent with other needs of the community must be considered. To offer practical solutions to the problem of moving traffic, a thoroughfare plan must be a reasonable compromise between the demands for movement and other, equally valid, local requirements -- among which are the provision of curb parking, preservation of residential amenities, and the enhancement of aesthetic values. Finally, the trafficways plan must provide a framework for all modes of transportation -- including pedestrian, private cars, trucks, transit buses, and rapid transit trains. Figure 18 shows the currently adopted "Select System" in Berkeley.

Major Street Classification and Control

No single type of street can serve the entire city efficiently. Rather, a properly balanced system of streets and highways, including differing types of facilities to perform varied functions, is required. A basic classification schedule for major streets is as follows:

Freeways

Expressways

Arterials

Collectors

Local Streets

Freeways are divided highways with full control of access and grade separations at all intersections. There are no deterrents to traffic flow such as traffic signals, parking or pedestrians. Freeways ideally provide rapid, safe movement of large volumes of traffic over relatively long distances.

Expressways are essentially partial freeways, the main distinction being that expressways may have some signal-controlled crossings at grade, and possibly some direct access from abutting properties.

Arterials are intended to serve primarily through traffic between different sections of the city, or through the city. They feed the freeway-expressway system. Although providing direct access to abutting property, they are generally regulated to favor through movement.

Collectors serve the dual purpose of providing movement of through traffic within a limited area and direct access to abutting properties. Their function is to support the arterial system by collecting traffic from minor streets and feeding it to arterials.

Local streets are terminal streets providing land access only.

In Berkeley, as in most cities laid out with a grid system of streets, it is often difficult to make a clear distinction between the last three street classifications on the basis of alignment, continuity, width of right-of-way or pavement cross-section. Almost all streets in the flat areas of the city may be classified as collector streets by the nature of their design. While traffic on minor streets must stop before entering or crossing an arterial, in only a relatively small number of cases are obvious priorities of movement established so as to discourage the use of essentially local streets for through movements within an area bounded by arterials. However, as part of the program of neighborhood development, some minor streets (such as Russell Street) have been physically closed by the installation of intersection dividers which divert traffic to intersecting streets, thereby eliminating the

18

1964
SELECT SYSTEM

LEGEND

STATE HIGHWAY
MAJOR THOROUGHFARE
SECONDARY THOROUGHFARE
PROPOSED EXTENSION
MAJOR STREET, OTHER JURISDICTION
COLLECTOR OTHER JURISDICTION

Note: The Select System was submitted by the City of Berkeley to the California Division of Highways, effective Sept. 22, 1964

NORTH
0 1 2 3 4 5 6
MAP SCALE IN THOUSANDS OF FEET

BERKELEY TRAFFICWAYS

Wilbur Smith and Associates

continuity of such streets. This appears to be a valuable tool to both the planner and the traffic engineer in their joint attempt to promote viable neighborhoods with efficient and safe patterns of circulation. Similarly, a number of collector streets are, in effect, nearly indistinguishable from arterial streets. The classification of streets and highways within Berkeley on a functional basis should be a first and important step in the development of a workable trafficways plan.

Future Freeways

Within the Berkeley area two new freeways have been proposed by the California Division of Highways. The first of these, the proposed Shoreline Freeway, would travel in a corridor generally west of and parallel to the existing Eastshore Freeway (U. S. 40, I-80). This proposed 8-lane freeway would essentially double the capacity of the Eastshore Freeway from the Nimitz Freeway to the north county line. At the time of this writing no plans for a definite location for the freeway have been made nor have interchange locations been established. Although not scheduled at present, this facility will probably be needed by 1980.

The second facility, the proposed Ashby Freeway, has been described as being "...a controversial issue in Berkeley for nearly twenty years."[1] Designated as part of the State Freeway Plan (Route 206), this facility would connect the Caldecott Tunnel leading to Walnut Creek with the Warren, Eastshore and Shoreline Freeways. The official position of the City of Berkeley has been that the acquisition of the large area of residential properties necessary for this right-of-way is an unacceptable solution of the problem of moving traffic. The Berkeley Master Plan states the position of the City as follows:

> Completion of the Grove-Shafter Freeway in Oakland and of the Regional Rapid transit system may relieve the demand for a State Route 206 Freeway to such an extent that it can no longer be justified as a link in the regional system. The problem of moving traffic safely and conveniently in and out of Berkeley may then be solved by improvements to surface streets that tie into the regional freeway network.

[1] Berkeley Master Plan, City Planning Department, 1963, p. 73.

No further consideration should be given to a State Route 206 Freeway until the Grove-Shafter Freeway and the regional rapid transit system are completed and their effect on regional traffic needs are known.[2]

On the basis of schedules announced for the Grove-Shafter Freeway and the Bay Area Rapid Transit system, these two facilities should be in operation by the year 1972. Until this time, unless the policy of the City changes, increased traffic volumes must be accommodated by increasing the capacity of the surface street system.

Future Traffic Growth

As indicated in Chapter III, it is estimated that, in general, an overall increase of approximately 20 percent in traffic volumes will occur by the year 1980. Certain corridors of movement will exceed this volume because of the individual characteristics of the area. For example, the South Campus Urban Renewal Area will experience a growth in excess of the 20 percent average value because of the local increases in population, employment and sales stimulated by redevelopment as well as some increase in traffic induced by better trafficways and improved parking facilities.[3] Similarly on streets in the vicinity of the West Berkeley Industrial Park area and the proposed Marina development area, traffic volumes will tend to increase in excess of the average predicted growth.

Traffic in the Ashby Avenue corridor will increase at a rate considerably in excess of the average rate. Traffic between Berkeley-Oakland and Walnut Creek-Moraga is anticipated to increase approximately 1.5 times to a volume of 125,000 to 130,000 vehicles per day.[4] Of this, from 75,000-80,000 vehicles may be expected in the Caldecott Tunnel. Such a volume would represent an increase of from

2 Ibid.

3 Traffic & Parking Study - Berkeley South Campus Urban Renewal Area, prepared for Urban Renewal Agency, City of Berkeley, by Wilbur Smith and Associates, 1964.

4 Alameda County Highway Master Plan, prepared for County of Alameda by Wilbur Smith and Associates, 1959.

45 to 55 percent over the 1963-1964 tunnel volume of 52,000 ADT. It is estimated[5] that approximately 25 percent of the tunnel traffic (roughly 18-20,000 vehicles per day) would have both origins and destinations outside Berkeley, either in San Francisco or to the north, and would use an Ashby Freeway, if available. Assuming no Ashby Freeway present, approximately 40 percent of this traffic (7,200-8,000 vehicles) would be diverted to the Grove-Shafter Freeway, rather than the more direct Ashby Avenue; the remaining 60 percent (10,800-12,000 vehicles) would travel on Ashby Avenue. Thus through traffic on Ashby Avenue (estimated at 20 percent of ADT - 1964) could be expected to double by 1980. The estimated growth of traffic on Ashby Avenue is summarized below.

Table 7

ASHBY TRAFFIC, EAST OF CLAREMONT AVENUE
Berkeley Trafficways Study

	Local Traffic	Through Traffic	Total Traffic
1964 ADT	25,900	6,500	32,400
Growth Factor	1.20	2.00	1.36
1980 ADT	31,100	13,000	44,100

On the basis of the design capacities noted in Chapter III (Table 1), a 6-lane, high-quality arterial will be required to accommodate the estimated 1980 ADT (average daily volume) of approximately 44,000.

5 Ibid.

In view of the fact that no significant changes in the general land use pattern of Alameda County have been apparent since the preparation of the Alameda County Highway Master Plan, the Ashby Freeway, indicated in that study, continues to be a reasonable projected need. This route, adopted in both the State Freeway Plan and that of the County, should be recognized as being a fundamental part of the overall solution to the problems posed by the traffic growth of the area. While improvements of the surface street system will provide relief to the system for a time, the Ashby Freeway is a necessary part of the area's highway transportation needs.

Recommended Plan

Figure 19 illustrates a plan for a major trafficways system for the City of Berkeley, working within the policy statements outlined in the City's Master Plan and the specific instructions of the contract under which this study was performed. The plan proposes a system of major and secondary trafficways with sufficient capacity to accommodate the volumes of traffic projected for the year 1980. In general this plan recognizes the pattern established by the work done in the past, but, in a few instances, proposes new connections to improve traffic service.

Special Considerations

In a mature city such as Berkeley the skeleton of a major thoroughfare system is usually well established. For this reason, there is little essential difference between the plan illustrated in Figure 19 and that shown in the Master Plan (Figure 2). Rather, the problem in a mature city is to improve the functioning of an already established and essentially developed street system. Specifically cited for consideration by the City are certain problem areas which have been examined and for which recommendations are presented as follows:

University Avenue -- Improvements were considered to increase the traffic capacity and to

19

RECOMMENDED TRAFFICWAYS PLAN

LEGEND

FREEWAY

ARTERIAL

COLLECTOR STREET

NORTH

0 1 2 3 4 5 6

MAP SCALE IN THOUSANDS OF FEET

BERKELEY TRAFFICWAYS

Wilbur Smith and Associates

reduce congestion and accidents. On July 8, 1964, the Berkeley City Council approved the preparation of plans for the improvement of University Avenue between 6th Street and Oxford Street. The improvement plan, to be considered jointly by the Civic Art Commission, the Recreation Commission, and the Planning Commission, with the cooperation of property owners and merchants of the area, calls for a complete reconstruction of this important street to improve traffic service, reduce accidents, reduce congestion, and to improve the visual aspects of visitors' entrance to the city.

The plan proposes that University Avenue be developed with a paving section similar to that utilized on Oxford Street south of Hearst. Dual 32-foot roadways, separated by a 16-foot median strip with provision for left-turn pockets, provide for two moving and one parallel curb parking lane in each direction of flow. The median strip would be landscaped and all utilities located underground.

This proposed improvement is endorsed as being the best practical solution for the treatment of University Avenue. The elimination of angle parking in itself will not only materially decrease the hazard associated with such parking but will also increase the capacity of this important thoroughfare. The separation of opposing flows of traffic and the segregation of left-turning vehicles in exclusive lanes, with separate turning movement signal cycles where warranted, will further enhance the efficiency and safety of the street.

The loss of curb spaces on University effected by the conversion from angle parking to parallel parking as required by the regulations governing use of gas tax funds could be offset by additional time limit spaces on the cross streets.[6] The question of the numbers and location of additional spaces, as well as the numbers and locations of truck loading zones, can best be determined through a study of existing parking usage along University Avenue.

Grove Street -- Alternative studies for widening Grove Street or for establishing a one-way

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[6] Improving University Avenue, Berkeley City Manager's Office, June, 1964.

couplet with an adjacent street were made. We have estimated future traffic along Grove Street (see Figure 20) to range from 16,500 to 21,000 vehicles per day. (It now carries from 14,000 to 18,000 ADT.) These volumes are within the capacity range of a four-lane, undivided arterial (64 feet, with parking; 48 feet, without parking). At present the roadway on Grove north of Berkeley Way is generally 40 feet; this width is now subject to traffic loadings over its practical capacity because curb parking is permitted. At present peak-hour prohibitions along both sides of the street are warranted and needed to reduce congestion on this important trafficway. South of Berkeley Way, a minimum of 56 feet of paving is available, allowing for four 10-foot moving lanes at all times (a substandard width), in addition to the curb parking.

Three alternatives appear possible with regard to the future design of Grove Street. In order of increasing cost they are:

Scheme 1 would widen Grove to a 44-foot roadway between Berkeley Way and Hopkins to provide four moving lanes at all times. Parking would be prohibited at all times and left turns would be prohibited during the peak-hours. This is clearly a less than desirable treatment of this important major street, and is cited as a possibility only because it can be accomplished without additional right-of-way. The cost of this widening, together with the needed reconstruction of the existing paving, is estimated at approximately $204,000. Needed reconstruction within the existing curb from Berkeley Way to Adeline would add an additional $263,600, and reconstruction from Hopkins to Solano would add another $85,000, for a total project cost of $552,600.

Scheme 2 would establish a one-way pair to provide the necessary capacity. Because of the configuration of the Grove-Josephine intersection, just north of Hopkins Street, this appears

20

1980 AVERAGE DAILY TRAFFIC FLOW

TRAFFIC SCALE

40,000 30,000 20,000 10,000

NUMBER OF VEHICLES

24 HOUR TRAFFIC VOLUMES

Source: Berkeley Public Works Department

NORTH

0 1 2 3 4 5 6

MAP SCALE IN THOUSANDS OF FEET

BERKELEY TRAFFICWAYS

Wilbur Smith and Associates

to be feasible. An alignment utilizing Josephine, Grant, and Harper could be developed to carry south-bound traffic to Adeline Street. A modest number of properties would be acquired to eliminate jogs or to connect parallel streets. Right-of-way for neither street, presently 60 feet wide, would require additional width. New paving would be necessary on both streets.

Total cost of the project (including reconstruction from Hopkins to Solano) is estimated at $1,626,300, of which $482,500 would be for the reconstruction of Grove Street and $1,252,500 for right-of-way, paving, and other work on the Josephine-Grant-Harper alignment.

While the necessary traffic capacity is provided, certain disadvantages should be noted. First, the scheme goes counter to the City's Master Plan policy by introducing arterial traffic into residential areas; approximately two miles of frontage would be affected. Second, it would leave the existing 56-foot wide sections of Grove Street south of Berkeley Way carrying only a fraction of their capacity. Third, the Adeline Street intersection would be somewhat more complicated than at present. Fourth, intersections of the new artery with other major streets would require signalization; eight new signals would be needed. Finally, the southbound No. 15 bus would be routed away from the central business district and the Civic Center.

Scheme 3 would widen Grove to a minimum 64-foot roadway (between Solano and Adeline) to provide four 12-foot travel lanes and two 8-foot parking lanes. This is a much superior facility

to that noted above because it provides both needed curb parking and a degree of operational flexibility lacking in the first alternative. By prohibiting parking for a distance of approximately 100 to 200 feet in advance of intersections with other major streets and collectors, adequate width is available for painted left-turn bays. This section requires a minimum 80-foot right-of-way to allow for sidewalks and utility easements; the present right-of-way is only 60 feet in width. Thus, this improvement will require the acquisition of a large number of properties in the section between Hopkins and Berkeley Way where only 60 feet of right-of-way is now available. North of Hopkins and south of Berkeley Way the right-of-way is adequate for the proposed paving section.

The estimated cost for right-of-way for this project is approximately $1,744,450. Construction costs of approximately $921,000 will bring the total project cost (Solano to Adeline) to $2,665,450.

Of the three schemes considered, the third is recommended as being the most efficient and appropriate response to the need for additional capacity within the guidelines of the Master Plan. The importance of Grove Street is, and will continue to be, such that the minimal widening of scheme 1 is not an adequate solution to the problem; the solution in scheme 2 provides adequate capacity but has undesirable side effects, as noted above. Although scheme 3 is the most costly, it appears to be the only adequate solution meeting all of the local criteria for improvement.

It should be noted that 1964 volumes north of University Avenue are already in excess of the practical capacity of the existing design. To provide the currently needed capacity it is recommended that peak-hour restrictions be applied to both sides of the street immediately. The banning

of parking on both sides, rather than merely in the direction of peak flow, is recommended to facilitate the large number of turning movements at cross streets.

Ashby Avenue - Tunnel Road -- Improvements as a major conventional surface street and the possible alternative of a one-way couplet with an adjacent street were considered. As indicated earlier, the future traffic projections in this corridor warrant a freeway here. If it is to be a matter of policy, however, that no freeway in this corridor will be considered by the City of Berkeley, substantial improvements to the existing Ashby Avenue will be necessary. In addition to the normal growth of peak-hour traffic along this route, the construction of the rapid transit station at Adeline Street (discussed in Chapter IV) will impose heavy volumes of traffic upon this street. On the basis of estimated peak-hour passenger arrivals and departures, estimated by the BARTD engineers, approximately 540 autos and 21 buses will enter or leave the station complex during the evening peak-hour.

As was the case with Grove, there are a number of possible methods of improving Ashby Avenue. Two have been investigated in some depth; the results of the investigations are indicated below.

The first alternative involves the establishment of a one-way pair with Russell Street. In this scheme, west-bound traffic would be routed over Russell and east-bound over Ashby. The two roadways would begin somewhere east of the S.P.R.R. grade separation and rejoin in the vicinity of the Claremont Hotel. This scheme would allow the traffic requirements of the Ashby Avenue corridor to be satisfied without major widening throughout the most intensively developed part of its course through Berkeley. In addition it would be possible to allow curb parking to remain throughout most, if not all, of the day. The scheme does, however, have a number of serious deficiencies. First, the problem of widening where no parallel street is available cannot be avoided. East of Claremont

Avenue, where over 44,000 vehicles per day are expected, six travel lanes will be required by 1980. Widening in this area will be expensive and cannot be avoided. Similarly, at the western end of Ashby, the need for six travel lanes will require widening of the grade separation with the Southern Pacific lines and redesign of the Eastshore Freeway access ramps. The provision of high quality transitions between the one-way roadways at either end of the street will require a large amount of right-of-way and will necessarily cut across blocks, affecting a relatively large number of properties in the area. Finally, the use of Russell Street as part of the one-way pair would require that the street diverters installed on Russell as part of the San Pablo Neighborhood improvement plan would have to be removed and the street entirely rebuilt for the large volumes of traffic to be introduced onto this residential street.

The alternative to the one-way system is the widening of Ashby Avenue to meet the demands which will be placed upon it. This would require two 36-foot roadways, separated by a 16-foot median (which would allow for protected left-turn bays), be developed. This cross-section would function either as six travel lanes during peak flow periods or as four travel plus two parallel curb parking lanes during off-peak hours. It would offer considerably more operational flexibility than the dual 32-foot section constructed on Fulton Street and proposed for University Avenue; the dual 36-foot section, however, requires a minimum right-of-way of 108 feet. The right-of-way of Ashby, which varies between 60 and 80 feet in width, will thus require substantial widening. Obviously, the acquisition necessary for widening will entail significant costs and dislocation of both residential and commercial structures. Near the western end of the street a short, one-block one-way pattern with Murray Street is proposed to eliminate the need to purchase substantial structures.

Although the problems associated with widening Ashby Avenue are substantial, the benefits to

accrue will be great. First, it consolidates the traffic service and commercial development along one important route; the neighboring residential streets should experience relief from traffic rather than an increase. Second, the problems associated with connecting the one-way streets (discussed in the first scheme) are not encountered in this proposal. This is particularly important near its western limits where a short one-way pattern, utilizing Murray Street for east-bound traffic, is necessary because of the unavailability of right-of-way for widening. Incidentally, the reconstruction of the Ashby Avenue pavement, needed in the near future, should be included under either the widening or the one-way scheme.

The costs comparison of the two schemes are summarized below.

Table 8

COSTS OF ASHBY CORRIDOR IMPROVEMENT ALTERNATIVES
Berkeley Trafficways Study

	ONE-WAY SCHEME	WIDENED ASHBY AVE.
East City Limits to College Ave.		
Right of Way	$ 812,500	$1,545,700
Construction	703,600	643,000
Sub-Total	1,516,100	2,188,700
College Ave. to San Pablo		
Right of Way	707,800	4,454,400
Construction	959,700	917,500
Sub-Total	1,667,500	5,371,900
San Pablo to Eastshore Freeway		
Right of Way	175,200	175,200
Construction	885,400	885,400
Sub-Total	1,060,600	1,060,600
Total	$4,244,200	$8,621,200

If the City desires to develop a surface street rather than the proposed freeway, it is recommended that the widening of Ashby Avenue be undertaken rather than the establishment of a one-way pair. In spite of the substantial cost of this project, it is believed that the recommended plan will provide both good traffic service and a better base for future land use development, in keeping with the City's Master Plan.

As an immediate interim measure, it is recommended that peak-hour parking prohibitions (now in effect from 9th to Adeline and from College to The Uplands) be extended to include the entire length of the street and to apply to both sides rather than only the direction of peak flow except from Domingo Avenue east to the city limit, where a complete prohibition of parking should be established.

Fulton Street -- Improvement of Fulton Street south of Bancroft Way and its relationship to Ellsworth Street was considered. It is estimated that in 1980 the daily traffic volume on the Fulton-Ellsworth couplet will range from 12,500 to 26,000 vehicles. Because of the relatively high percentages of peak-hour volumes (12 percent of south-bound movement and 11 percent of north-bound movement occurs during the period between 5:00 and 6:00 P.M.), the critical segments between Bancroft and Dwight Way will have to carry approximately 3,100 vehicles during the evening peak hour. These volumes will require at least six travel lanes, three in each direction, during the evening peak-hour in 1980.

The Planning and Public Works Departments of the City of Berkeley have recently prepared a plan which would extend the two-way section of Fulton one block south to Durant Avenue. This widening, planned for the fiscal year 1964-'65, will provide three travel lanes southbound and two travel lanes northbound. The sections will be separated by a 4-foot raised median. The present 60-foot right-of-way is to be widened to 84 feet and the necessary construction done for a total cost of $200,300. This improvement should make possible a reduction in the volume of traffic on Shattuck Avenue north

of Bancroft somewhat by providing a better connection for northbound traffic. Because of the particular pattern of one-way streets in this area, no significant operational problems are anticipated.

Apart from this improvement and the future study of warrants for a traffic signal at Ellsworth and Bancroft, the only improvements recommended are concerned with widening of Fulton and Ellsworth Streets to secure adequate lane widths. At present on Fulton, between Durant and Ashby, and on Ellsworth, between Bancroft and Carleton, only 36 feet of roadway are available. This dimension is not adequate for two travel lanes and two parking lanes as presently used. It is recommended that each of the two one-way streets be widened to 44 feet -- a dimension which will normally provide two travel and two parking lanes and, in periods of peak demand, three travel lanes and one parking lane. With 8-foot sidewalk areas, no additional right-of-way will be required. The cost of improving Fulton is estimated at $241,100; the improvement of Ellsworth is estimated to cost approximately $241,000.

It should be noted that the structural condition of the pavement of these two streets is considered as fair-to-poor and would certainly require resurfacing in the near future. The costs of these reconstruction projects, included as part of the overall improvement costs, above, would be approximately $105,800 (Ellsworth) and $89,300 (Fulton).

As an alternative to the widening of Fulton and Ellsworth to 44-foot roadways, widening to give a minimum 40 feet of street is an acceptable (second best) option. While this section will not accept three moving lanes at desirable major street speeds, it can (with the prohibition of curb parking at intersection approaches) accommodate three lanes at signalized intersections. The total cost of widening and repaving Ellsworth to a minimum 40-foot section is estimated to be $208,300; Fulton Street would cost approximately $183,100.

Dwight Way -- Alternative studies were made of widening Dwight Way west of Grove Street or of establishing a one-way couplet: Dwight Way and the Dwight-Haste couplet (east of Grove) are at present an important east-west facility serving the South Campus area as well as other intra-city traffic. The 1964 daily volume on this route ranged between 5,750 and 11,850 vehicles. At present the utility of the route is limited by the fact that no external connections with other major trafficways exist. By 1980, however, it may be assumed that a second freeway facility has been constructed (parallel to the Eastshore Freeway) and that a connection to this freeway is considered feasible. The new connection with the freeway would have the effect of diverting from University and Ashby Avenues those vehicles which would be better served by Dwight Way, including a large part of campus-destined traffic. Estimates of traffic volumes in 1980 with this type of service would range from 10,000 ADT (west of Sixth Street) to 28,000 ADT (west of Telegraph Avenue).

At present the operation of both Dwight Way and Grove Street are hampered by the fact that Haste -- the westbound part of the Dwight-Haste couplet -- now stops at Grove. Westbound traffic is thus forced to jog a block north or south before being able to continue to the west. Two alternatives to the combined problem of providing sufficient capacity and of eliminating the discontinuity at Haste have been explored. The first of these is the connection of Haste into Channing Way and the continuation of the one-way pair west of Grove. The second scheme involves the connection of Haste with Dwight Way (west of Grove) and the widening of Dwight (to the west) to provide more capacity.

As indicated in the earlier discussions of new one-way streets, the Haste-Channing route suffers from the problem of introducing large volumes of traffic onto an existing residential street and of doubling the number of traffic signal installations required. Also, because the existing paving on Channing is not adequate to bear the loading of arterial traffic volumes, this street would have to be completely reconstructed to serve the purpose; portions of Dwight Way will also have to be rebuilt as

they are now in poor repair. In addition to these problems, a further complication arises from the necessity to bridge the Aquatic Park and Eastshore Freeway to provide a connection with the new Shoreline Freeway. If a Dwight-Channing one-way pair is used, either two structures would be required or an expensive transition back to a single roadway would be necessary. A similar problem would result with the need to separate Dwight Way traffic from railroad traffic at Third Street.

The connection of Haste into Dwight Way and the widening of Dwight west of the connection also presents problems because the present 60-foot right-of-way will require substantial widening to serve the anticipated traffic demands. Although a substantial number of properties will be affected, the best approach for Dwight Way in terms of both traffic service and planning objectives, is recommended to be a dual 36-foot, divided section, west of the new connection. Similar to that recommended for Ashby Avenue, this will require 108 feet of right-of-way.

East of the proposed Dwight-Haste connector the existing one-way pattern of travel would be retained. Both Dwight and Haste are recommended to be widened to a 44-foot cross section to allow three full travel lanes to be in use during periods of peak demand. On Haste Street, recently reconstructed to 40 feet, only a simple widening is required; on Dwight Way, much of the paving will have to be reconstructed. In terms of cost, the second scheme with the Dwight-Haste connection and a widened Dwight Way is considerably more costly than the first (a Haste-Channing connection) if the connection(s) to the freeway are ignored.

The recommended plan, which is to widen Dwight Way (from the S.P.R.R. to Grant) to dual 36-foot roadways, to connect Dwight and Haste between Grove and Grant, and to widen both Dwight and Haste from Grove to Piedmont to 44-foot sections will cost an estimated $2,932,200. The alternative, with Dwight one-way westbound and Channing-Haste one-way eastbound, developed to 44-foot cross-sections throughout, is estimated at $1,407,600. The connection of Dwight and

Channing, west of Sixth Street, would add approximately $229,600 to give a total cost of $1,637,200. The structure connecting with the Shoreline Freeway is estimated at $4.5 million.

In addition to the section of Dwight Way shown on the Trafficways Plan, the extension of this street to the east, to provide better access to Panoramic Hill, has been included in the current Capital Improvement Program. The cost of this project has been estimated by the City staff at $40,000. This extension, together with the section of Dwight Way east of Piedmont, is indicated as a collector street on the Recommended Plan (Figure 19).

Shoreline Freeway -- A study of the need for and functional feasibility of a second freeway parallel and in close proximity to the present freeway was made as directed. In the five years (1958-'63) traffic on the Eastshore Freeway has increased approximately 32 percent -- from 77,400 to 102,000 ADT. In 1959 it was estimated[7] that by 1980 this corridor would carry 163,000 vehicles per day. Thus, in five years, almost 29 percent of the increase projected for the 22-year period has already occurred. At present the 8-lane Eastshore Freeway is operating slightly above its practical capacity level of 100,000 vehicles per day. While there are a number of 8-lane urban freeways carrying in excess of 120,000 vehicles per day, these characteristically are marked by low peak-hour percentages of daily volumes. In this corridor the lack of suitable supplementary facilities is also important. San Pablo Avenue, the only through route connecting Oakland and Richmond, is at present operating with volumes in excess of its capacity. No relief to the Eastshore may be seen from this facility without drastic improvements. In view of the operating characteristics of the Eastshore, it appears that a second, parallel facility will definitely be needed prior to the year 1980.

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7 Alameda County Highway Master Plan, prepared for County of Alameda by Wilbur Smith & Associates, 1959.

The second freeway will have two directly beneficial effects upon the Berkeley trafficways system. First, it will reduce substantially the traffic loads on the Eastshore Freeway (and, to a lesser extent, San Pablo Avenue). Second, by providing additional access points to major streets within Berkeley, the east-west traffic associated with the freeways will not be consolidated on a few, heavily traveled throughfares, as at present. A scheme has been proposed by the staff of the City of Berkeley in which Dwight Way and Cedar Street would interchange with the new freeway which would be located close to and parallel with the existing Eastshore Freeway. This scheme appears to have a great deal of merit. As indicated earlier, such a connection would tend to reduce the impact on the Ashby Avenue, University Avenue and Gilman Street interchanges and would distribute east-west traffic over five major streets rather than three as at present.

There are, of course, problems associated with this plan as with any project of this magnitude. To provide the necessary connections with Cedar and Dwight Way, structures must be provided which will allow vertical clearances adequate for both the Eastshore Freeway and the Southern Pacific main line tracks along Third Street. The crossing of Cedar is complicated by the fact that the grade separation with the railroad on that street is proposed to be an underpass. This, however, is basically a matter of design. The extension of Dwight Way, because of the necessity of crossing the Aquatic Park, presents a more complex question. The park is now a relatively undeveloped rim of land surrounding a 97-acre lake. A single loop road around the lake provides access to points within the park. The City of Berkeley has initiated a program to improve the park by dredging the lake, improvement of access and the installation of new facilities. Clearly, an extension of a six-lane structure across the middle of the lake could have a significant effect upon the park site.

To ensure that such a connection could be effected in harmony with the park and lake area

will require a more detailed study of design alternatives than can be reported here. Because the proposed connection of Dwight Way would have such a marked effect, it is recommended that the City's urban design consultant, the Civic Art Commission and a structural design consultant be closely involved in the planning of the structure.

Waterfront Major Street Network -- A study was made of the extension of major streets across the Eastshore Freeway and of major circulation routes needed to serve waterfront development consistent with present City Council policy. The "Interim General Waterfront Development Plan," as adopted by the City Council, November 18, 1964 (Plate 15), indicates a land-use plan of the filled area west of the Eastshore Freeway together with a schematic system of major and secondary streets to serve this area. In this plan University Avenue and Gilman Street are shown as east-west major streets; Cedar, which would cross the Eastshore without interchange, is shown as a collector street. A new street, Marina Boulevard, is shown as the single north-south collector street in the area, extending from Gilman to University. Neither a westerly extension of Dwight Way nor the Shoreline Freeway are indicated. The bulk of the area, identified as to land-use, is classified as recreational; the remainder is "commercial-recreational." These two categories make up only about one-half of the available land area; the remainder is classified as "area for further study".

In view of the uncertain nature of the development, no intensive studies of traffic generation have been made in this area. Rather, the plan illustrated in Plate 15 has been examined as to the general adequacy of the connections from the waterfront area to the freeway and to the city area east of the freeway.

The suggested pattern appears to be completely adequate both as to spacing and connections. Assuming each street to be at least four lanes wide, this network would have a nominal capacity of up to 75,000 vehicles per day. An estimate of Marina-oriented traffic (1980) crossing a "screenline"

immediately west of the freeway frontage road of 10,000-12,000 ADT indicates that sufficient capacity should be available for even peak loadings.

Gilman Street -- The improvement of Gilman Street from the Eastshore Freeway to Hopkins Street and the proposed extension to tie into Sacramento Street was investigated. Gilman Street is presently one of the three major streets in Berkeley which affords access to the Eastshore Freeway. Between the freeway and San Pablo Avenue it traverses a substantial industrial area; east of San Pablo it is through a low to medium density residential area. As Cedar Street does not now connect with the freeway, Gilman Street is used by a substantial number of drivers to reach it; a circuitous route involving Gilman-Hopkins, Sacramento and Cedar is necessary. Among the most important problems associated with Gilman Street is the connection with Sacramento.

Sacramento Street, a major north-south street, now terminates at Hopkins. Movements from this point are primarily in three directions -- west via Hopkins to Gilman, north via Hopkins to Monterey, or east via Hopkins. The intersection of Sacramento with Hopkins is thus both busy and congested by the complexity of the turning movements. At present this intersection is controlled only by a single stop sign on Sacramento.

To improve this intersection a redesign of the intersection, shown in the sketch on the following page, is proposed. A direct connection of Sacramento with Monterey is recommended together with the extension of Gilman Street southward to connect with the realigned Sacramento shown.

The alignment shown in this sketch provides for the continuity of the north-south movement; the movement from Gilman to Sacramento is greatly improved over the existing situation as well. This project does, however, involve a major alteration of the existing area. Twenty-eight properties are involved, and the necessary right-of-way acquisition costs are estimated at $432,550. Con-

struction costs of approximately $117,450 and new traffic signal installations at Monterey and Hopkins, Gilman and Sacramento, and Gilman at Hopkins would bring the total project cost to $550,000.

On Gilman Street to the west, traffic volumes of from 10,000 to 13,500 vehicles per day indicate the need for only a two-lane major street. To avoid, insofar as possible, the acquisition of property unless absolutely needed, it is recommended that a 44-foot roadway within the existing 60-foot right-of-way be used east of San Pablo and a 48-foot section (in the existing 80-foot right-of-way) west of San Pablo. While peak-hour prohibition of parking will be necessary at certain points, these sections offer the best balance between cost and benefit. Total cost is estimated at $273,300.

To eliminate the hazards and delays associated with the grade crossing with the Southern Pacific Railroad main line at Third Street, an overpass is recommended for this crossing. A four-lane structure, estimated to cost $800,000, is recommended.

It might be noted that in one area of Gilman -- the small commercial development at Santa Fe Street -- the construction program of the BARTD affords a possibility of improving the potential of the area and, at the same time, of improving the traffic carrying capacity of the street. Right-of-way

requirements of BARTD will mean that a significant part of the existing development on both sides of Gilman, between the AT & SF Railroad and Santa Fe Street, will be demolished. Under normal procedures, after transit construction, excess right-of-way would be reparceled and sold; and the area under the structure landscaped and fenced. Because a current lack of off-street parking exists in the area, the City should consider the desirability of these areas as off-street parking facilities. The acquisition of the land from the BARTD for this use, in return for the maintenance of the area used, should be possible. The City is restricted by the terms of other off-street parking bonds from constructing new facilities, thus an agreement with the area merchants, having them guarantee the difference between costs and income, appears to be a reasonable solution. Such addition of parking spaces would reduce the inhibiting effect which peak hour parking prohibitions impose on the competitive position of the retail establishments.

San Pablo Avenue -- The desirability of installing a median island with left turn bays was studied. San Pablo Avenue (U.S. 40 - Business Route) is a very important Berkeley street -- both as a trafficway and as a lengthy strip commercial development. During 1964, its traffic volumes ranged from 19,500 to over 21,000 ADT. These volumes were carried on an undivided paving section 74 feet wide. In this relatively narrow width, six travel lanes and two parallel curb parking lanes are indicated by pavement markings. Based on a desirable range of 30 to 35 miles per hour for this type of area, overall operating speeds are low. South of University Avenue, off-peak speeds are in a range from 23 to 26 miles per hour; north of University Avenue, the range is from 30 to 36 miles per hour. However, the delay here is no worse than that found on other north-south major streets. Also, while the collision index of from 7 to 15 (see Appendix A-2) is rather high, the San Pablo Avenue rate of 205 injury accidents per 100-million vehicle miles of travel remains lower than on many other streets in Berkeley.

Although desirable from a functional standpoint, widening San Pablo Avenue to provide a median island with left-turn bays is not recommended at this time. Construction of the Shoreline Freeway should do much to relieve the traffic loading on San Pablo Avenue, and it is believed that the City would do better to use its energies to promote the early construction of the freeway than to widen San Pablo Avenue.

However, if San Pablo Avenue were to be widened, alternatives are available. The street could be rebuilt with two 32-foot roadways and a median within the present right-of-way (see University Avenue, page 38). Due to the dependence on curb parking by commercial uses along San Pablo Avenue, however, the necessary removal of parking during the peak hours reduces the practicality of such a plan. Another method would create dual 44-foot roadways with three full travel lanes and curb parking for each direction of travel. For this cross-section an additional 24 feet of right-of-way would be required. Thus, to provide a divided roadway and curb parking would necessitate removing many of the very businesses generating parking demand. Finally, if reconstruction becomes necessary, consideration could be given to six 11-foot lanes and two 8-foot parking lanes with 9-foot sidewalks, within the present right-of-way as a compromise design. Cost of this section has been estimated at $1 million, however.

On the basis of these facts and the apparent lack of plans for upgrading San Pablo Avenue in the neighboring cities, a divided roadway could only be recommended as part of a comprehensive program of redevelopment if an adequate supply of off-street parking were made available and if a cooperative plan were devised by the cities of Emeryville, Albany, and El Cerrito, in conjunction with the City of Berkeley.

Shattuck Avenue -- The proposed extension of East Shattuck Avenue from University Avenue to 'North' Shattuck Avenue at Berkeley Way was considered in this analysis. The extension of East Shattuck Avenue (see Figure 15) northward to provide a continuous north-bound movement across University Avenue is a much needed improvement which will have an extremely beneficial effect on peak-hour traffic conditions throughout the central business district. At present, northbound Shattuck Avenue traffic is commonly found to back up for two to three blocks south of University Avenue as a result of the peak-hour congestion at this intersection. Although the cost of this project, estimated by the City staff at $270,000, is substantial, the potential benefits far outweigh this disadvantage.

In addition to this much needed improvement, other work will also be necessary to bring Shattuck Avenue up to the development level needed when the opening of the Berkeley Station of the BARTD further increases the demands upon this important street. Estimates of 1980 traffic volumes on Shattuck range from 18,000 to 22,000 vehicles per day in the critical section between Hearst and Durant. While these volumes are not greatly higher than now found, the peak-hour percentage is expected to be altered considerably. Assignments of transit-oriented traffic (P.M. peak-hour, peak design day, 1975) to the streets surrounding the Berkeley Station indicate that northbound traffic south of University will probably increase from the 1964 volume of 760 vehicles per hour to approximately 1,050 vehicles per hour. With an assumed 50 percent green time, three full travel lanes will be required in addition to the necessary bus landing zones. A minimum cross-section of 44 feet appears to be necessary to support this volume. During off-peak periods parallel parking on either or both sides of the street may be permitted. From a traffic service standpoint it would be desirable to eliminate the diagonal parking from all of the major streets in Berkeley. Because of the particularly

critical role of Shattuck Avenue in the area near the rapid transit station, the elimination of diagonal parking is mandatory here.

Colusa Avenue -- The realignment of Colusa Avenue at Solano Avenue was studied as part of the improvement of this street. The existing intersection of Colusa at Solano does not allow for a continuous north-south movement. The center line of Colusa north of Solano is off-set approximately 170 feet west of that south of Solano. This discontinuity necessitates a great number of turning movements and creates unnecessary hazards to both motorists and pedestrians. During the first four months of 1964, four collisions occurred at this intersection. The recommended extension of Sacramento into Monterey will increase the attractiveness of Monterey-Colusa as a north-south route and will intensify the existing problem at Solano.

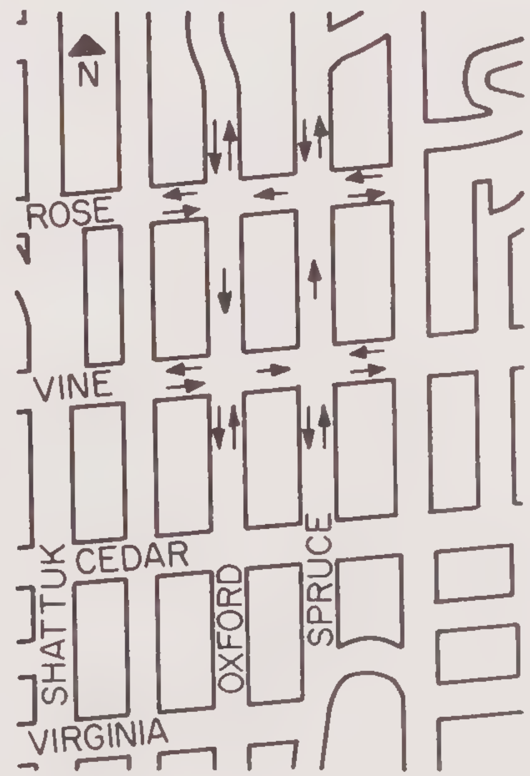
A realignment of Colusa has been proposed as shown in the sketch below. Only four properties are involved; right-of-way for this project is estimated to cost $171,100. The realignment of Colusa to form a continuous roadway is estimated to cost an additional $29,000. A traffic control signal at Colusa and Solano is included in this estimate.

Oxford-Spruce -- Study was made to provide an adequate trafficway to connect Oxford Street at Virginia with Spruce Street at Rose Street. The Fulton-Oxford-Spruce route is an important north-south facility which is complicated by the barrier of the U. C. campus, the topography of the Berkeley Hills, and the existing street network. North of Hearst Avenue

traffic volumes of 9,000 to 10,000 vehicles per day are carried on this system. At present traffic on Oxford must use a one-block section of Rose Street to reach Spruce Street. This maneuver results in an unnecessary degree of peak-hour congestion, low operating speeds and unnecessary hazard. As traffic volumes increase this condition can only become more serious.

Two methods of improving the alignment of this route were considered. The more direct of these -- the construction of a physical link between Oxford and Spruce in the form of a new roadway -- was discarded as being both too expensive and incompatible with the character of the area. The second method, the establishment of a one-block, one-way distributor system, is recommended as being the more acceptable of the two possible solutions.

In the recommended plan (shown in the sketch on the right), Oxford would be designated as a south-bound street between Rose and Vine; Spruce would be north-bound within the same limits; between Spruce and Oxford, Rose would be a one-way west-bound street, and Vine a one-way east-bound street. While traffic would still be forced to make two turns, the separation of conflicting traffic should, by facilitating these turns, increase the level of traffic service and reduce the potential hazard associated with this route.



South of Rose Street, the paving on Oxford Street should be widened to give a minimum 44-foot section. Between Vine and Eunice, Spruce should also be 44 feet in width. North of Eunice, widening to 40 feet is recommended. The cost of the total project, from Virginia to Eunice, is estimated to be approximately $191,000.

Adeline Street -- For this street the improvement of Adeline Street from Shattuck Avenue to the south City limits was considered. The

development of the BARTD line along the Grove-Adeline-Shattuck route will have a significant effect upon traffic patterns in the southern part of Berkeley. Present plans of the City of Oakland call for the reconstruction of Grove Street, south of Adeline, to dual roadways (with aerial transit in the median) with three travel lanes and one parallel curb parking lane in each direction of travel. This same section would be used on Adeline Street to the Ashby Avenue Station where a different section, adapted to the needs of the station, would be used. North of Ashby the 1980 estimated volume of 12,000 will require dual 32-foot roadways if curb parking is to be retained. As the paving in this area is now in very poor condition, a complete reconstruction is called for. Two additional signal locations appear warranted. The first is at Grove Street, adjacent to the Ashby Avenue Station; the second is at the intersection of Adeline and Shattuck.

Gayley Road -- Consideration was given to the function and design of Gayley Road and the possible connection to Cedar Street and the southerly extension via Piedmont, Warring, Derby, Belrose, Claremont Boulevard to Tunnel Road. Gayley Road and its extensions are the most easterly north-south trafficway in the City of Berkeley. Volumes of 12,000 to 15,000 vehicles per day are now carried on this route; by 1980 this is expected to increase to 14,000-18,000. The route is discontinuous, passes through a variety of land use areas and encounters a wide range of topographic features. At its northern terminus, near Hearst Avenue, the route is presently blocked by extreme topographic restrictions and a densely built-up residential area. The route serves both local circulation needs (particularly to the University of California, through which a portion of the street runs, and the Radiation Laboratory) but the bulk of the traffic is judged to be relatively long distance trips, worthy of the service provided by arterial street design.

In view of the traffic volumes projected for 1980, a minimum of four travel lanes will be required for this route. The recommended cross-sections are summarized below:

Table 9

RECOMMENDED DESIGN FOR GAYLEY ROAD
Berkeley Trafficways Study

STREET	LIMITS	R.O.W. (feet)	PRESENT CROSS-SECTION (feet)	RECOMMENDED CROSS-SECTION (feet)
La Loma Ave.	Le Conte - Hearst	60	36-33	40
Gayley Rd.	Hearst - Bancroft	60	28	44
Piedmont Ave.	Bancroft - Dwight	100	23/23	24/24
Warring St.	Dwight - Derby	73	43	43
Derby St.	Warring - Belrose	61	37	44
Belrose - Claremont Blvd.	Derby - Claremont Ave.	80	40	44

In addition to the widening indicated, channelization will be necessary at the intersections of Gayley and Hearst, Piedmont at Derby, Belrose at Derby, and Claremont Blvd. at Claremont Avenue. No additional right-of-way should be necessary for this, however.

It is anticipated that peak-hour parking restrictions will continue to be necessary throughout the length of the route; in some areas parking should be prohibited at all times.

The costs of the recommended improvements are estimated to be $306,150.

The desirability of extending Gayley Road north of Hearst to connect with La Loma at Cedar Street was considered but was rejected because its cost would not be proportionate with the benefits. Because of the extreme topography of the area a structure 800-1,200 feet in length would be necessary to make this connection; in addition, a large number of properties would need to be acquired to provide the necessary right-of-way. In view of the cost of this project, the alternative Hearst-Euclid-Cedar

routing now used appears a reasonable and adequate alternate. The widening of Hearst, now in progress, and the planned improvements of Ridge, Le Conte and Euclid should improve the present route substantially.

Sixth Street -- Improvements were considered to this north-south route, including Hollis Street (in Emeryville) via Seventh Street and Sixth Street to Gilman Street. 1964 volumes on the Sixth-Seventh Street route ranged from 4,850 (south of Gilman) to 9,200 vehicles per day (north of Ashby). North of Dwight Way (where the transition from Sixth to Seventh is effected), the street has a 48-foot roadway on an 80-foot right-of-way. South of Dwight Way the pavement varies between 43 and 46 feet; the right-of-way width is 60 feet. As the route travels through the industrial area of Berkeley, a higher than normal proportion of the traffic using the route is truck and tractor-trailer combinations. South of Ashby Avenue there is a sharp off-set in the alignment of the route; the center-line of Hollis Street is off-set approximately 480 feet to the west of the center-line of Sixth Street.

Estimated traffic volumes in 1980 range from 6,500 to 11,500 vehicles per day. This volume is within the capacity of a two-lane street with parking. To accommodate the parking and turning requirements of commercial vehicles, it is recommended that the 48-foot section found north of Dwight Way be continued to the south. No additional right-of-way will be necessary for this widening. The cost of this project is estimated at $168,000 (Dwight Way to Ashby Avenue) and includes resurfacing of the existing paving.

With the development of short sections of Ashby and Murray Street as one-way streets (see discussion of Ashby Avenue, above), the delay which is often experienced at this intersection should be reduced. The realignment of Seventh and Hollis is not deemed justifiable in view of the very small volume of conflicting traffic.

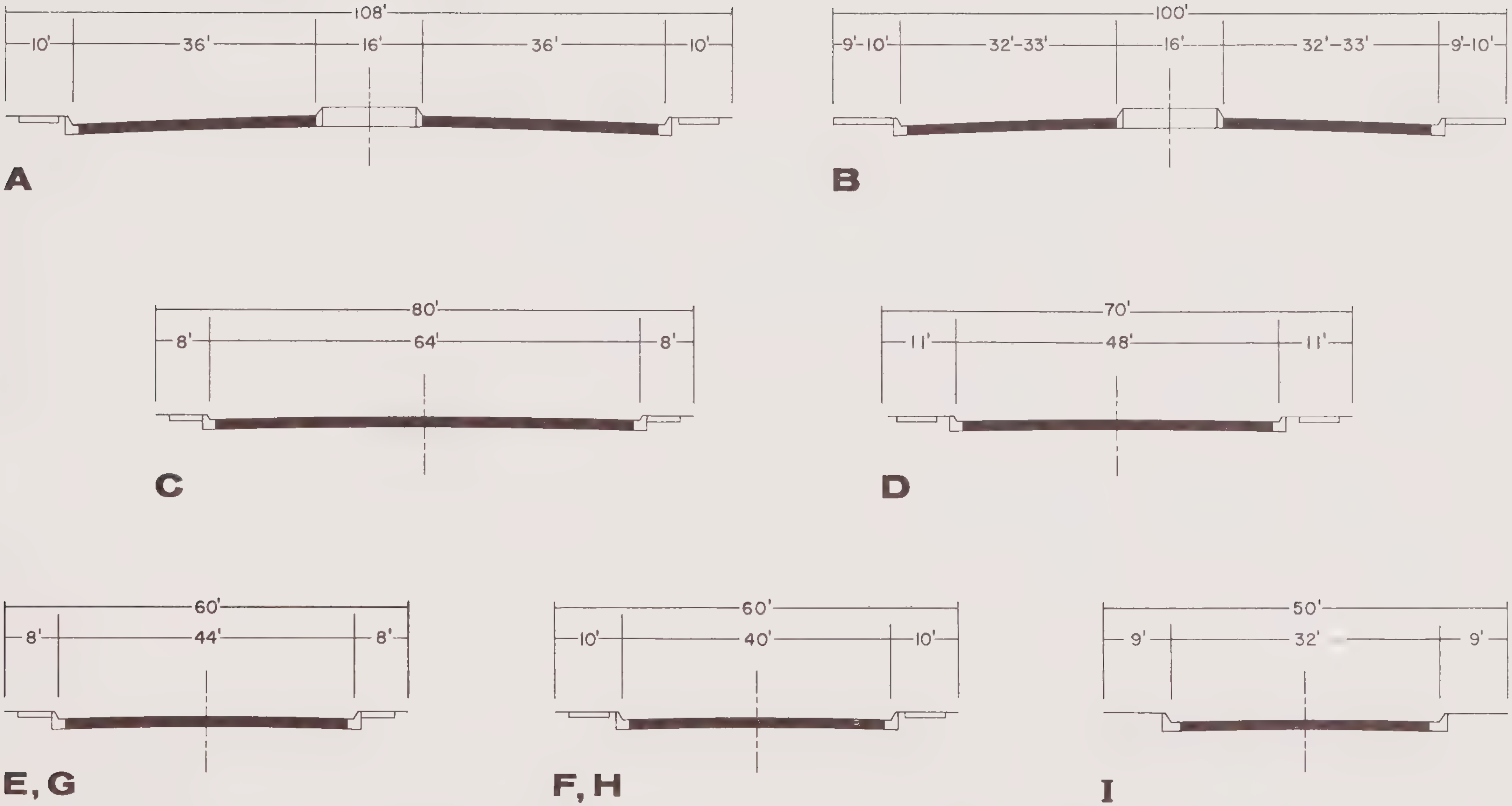
Design Standards

Figure 21 illustrates the cross-sections recommended for the implementation of the Trafficways Plan. Because of the variation in topography found within the City of Berkeley, two categories of design have been indicated -- one for the hill areas and one for the more level parts of the city. Table 9 summarizes in tabular form the cross-sections illustrated in Figure 21.

Because Berkeley is a mature city with almost all of its available land improved, the widening of existing streets to desirable sizes is an expensive task. In addition to the cost of buying additional right-of-way, the widening of major streets to ideal cross-sections will necessarily involve the relocation of existing homes and businesses. For this reason, every attempt has been made to keep the scale of needed street improvements in line with the other announced goals of the community. One effect of this course of action is that more cross-sections are recommended than are normally found in such a study. Rather than a few 'ideal" cross-sections, each street has been fitted with a section suited to its specific needs.

Section A describes an arterial street capable of carrying traffic in the range of 32,000 to 37,000 vehicles per day on six moving lanes or 20,000 to 25,000 vehicles per day on four lanes. The 36-foot roadway is compatible for either use; three 12-foot lanes are provided in each roadway. The opposing flows are separated by a 16-foot median which provides space for protected left-turn lanes, pedestrian refuge, and for the installation of traffic control devices. A 10-foot border area is required for sidewalks, utility easements, and planting areas. A 108-foot right-of-way is a minimum width for this section.

Section B is recommended for 4-lane arterials where turning movements are sufficiently heavy to require protection. Each 32- or 33-foot roadway allows for two moving lanes and a parallel parking lane; parking should be restricted for a distance of at least 60 feet at the approaches of signalized inter-



21
RECOMMENDED CROSS SECTIONS

sections to allow for right turns. The median design for section B is identical to that of section A. A 100 foot right-of-way width is required for section B. Where sidewalk capacity is important (such as University Avenue) the 32-foot roadway is practical; otherwise the 33-foot dimension is preferable.

Section C is recommended as a 4-lane arterial for areas where curb parking is necessary and where turning movements are not so high as to require separate lanes. On the 80-foot right-of-way a 64-foot paving section provides for four moving and two parking lanes. This section should accommodate from 17,000 to 22,000 vehicles per day.

If curb parking is not a controlling factor, a 4-lane business street may be constructed using section D. Using a 68- to 70-foot right-of-way, the recommended 48-foot paving section allows for the development of four 12-foot lanes; parking prohibitions on either an all-day or peak-hours basis will provide four usable moving lanes.

A 44-foot paving section is recommended (type E) for one-way arterials. This section will accommodate either two moving and two parking lanes or three moving and one parking lanes on a 60-foot right-of-way. The 2-lane street should have capacity for 12,000 to 18,000 vehicles per day, and the 3-lane street should accommodate from 14,000-20,000 vehicles per day.

Section F is recommended for collector streets. The 40-foot paving section provides for two moving and two parking lanes on a 60-foot right-of-way and will sustain volumes of 6,000 to 8,000 vehicles per day.

Section G is recommended for arterials in the hill areas where feasible. The 44-foot paving section on a 60-foot right-of-way will provide for two moving and two parking lanes. Capacities will be determined to a large degree by grades. Because only one moving lane is present in each direction, curb parking should be prohibited for a distance of 100 feet on each side of intersections to prevent

turning vehicles from interfering with the through movements.

A special section, type H, is recommended for use on hill-area trafficways where right-of-way is limited or where side slopes are excessive. A 32-foot paving section allows for 2 moving lanes and a curb parking lane.

Table 10

RECOMMENDED DESIGN STANDARDS
Berkeley Trafficways

TYPE	CHARACTER	RIGHT OF WAY WIDTH (feet)	PAVING WIDTH (feet)	NO. MOVING LANES	NO. PARKING LANES	WIDTH OF MOVING LANES (feet)	WIDTH OF PARKING LANES (feet)	WIDTH OF MEDIAN (feet)	WIDTH OF BORDER (feet)
GENERAL									
A	Arterial	108	36/36	6-4	0-2	12	12	16	10
B	Arterial	100	32-33/32-33	4	2	12	8-9	16	9-10
C	Arterial	80	64	4	2	12	8	-	8
D	Arterial	70	48	4-2	0-2	12	12	-	11
E	One-Way Arterial	60	44	3-2	1-2	12	8-10	-	8
F	Collector	60	40	2	2	12	8	-	10
HILL AREAS									
G	Arterial	60	44	2	2	12	10	-	8
H	Alternate Collector	50	32	2	1	12	8	-	9

It may be noted that some of the recommended improvements do not conform to the standards discussed here or to those established by the State of California. While the standards were considered in every case, a deviation from them is recommended in some instances because of other factors -- such as excessive grading requirements, or aesthetic considerations. Deviation from these established dimensions might also be considered reasonable when the cost of improvement is disproportionately large when compared with benefit (such as the widening of Warring St. from current 43 to the standard 44 feet). It is believed that the few deviations recommended in this report are justified on these grounds.

VI IMPLEMENTATION

In the preceding chapter the recommended Trafficways Plan was presented along with alternative solutions for specific problems. In this chapter the phasing of the construction program necessary to implement the plan is outlined. Cost estimates of both right-of-way and construction have been calculated on the basis of 1964 prices and do not reflect possible escalation.

Phasing of Improvements

The list of recommended improvements has been divided into two general phases -- one to be effected by 1970, the second to be completed by 1980. In this process four criteria have been used:

1) relative need for improvement
2) interrelationship with other projects
3) cost of the project, and
4) feasibility and effectiveness of temporary or interim improvements.

In the following pages the program phasing is outlined, costs estimated, and the basis for the need indicated. It should be again noted that the sufficiency rating discussed in Chapter III does not establish an automatic system of priorities for the improvement of Berkeley trafficways. Because this objective analysis is not tempered by such non-technical aspects of programming as city policy goals, the need to meet time tables established by other projects, and the effectiveness of interim improvements, the ranking serves to indicate areas of concern to which the attention of the City must be directed. For this reason many of the projects indicated as having the highest priority in terms of the mathematical sufficiency rating are recommended to be deferred until the 1970-1980 program while certain relatively low-rated streets (such as those needed to be developed in coordination with the BARTD) are recommended for the initial improvement period.

First Phase Improvements

The improvements proposed for the first stage may be classified as one of two groups -- those which require significant capital improvements and those which may be effected by the application of appropriate traffic engineering techniques. Although these two groups are both included in the same general phase, each is discussed separately below.

Immediate Traffic Engineering Improvements -- Areas where traffic engineering improvements are recommended to ameliorate existing conditions of hazard or congestion are shown in Figure 22, indexed in accord with the numerical listing below. Existing turn restrictions, one-way streets and parking restrictions facilitating traffic movement (discussed in Chapter III) should be retained. Recommended for immediate implementation are the following changes in the operation of trafficways within Berkeley:

Peak-hour parking restrictions, both sides of street

1. Grove Street - Hopkins to Berkeley Way
2. Vine Street - Oxford to Spruce
3. Rose Street - Oxford to Spruce
4. Hearst Avenue - Shattuck to Grant
5. Hearst Avenue - Highland to Arch
6. Piedmont Avenue - Bancroft to Dwight Way
7. Ashby Avenue - Seventh to Domingo

Peak-hour parking restrictions, peak direction

8. Cedar Street - Kains to Tenth, Josephine to Bonita and Oxford to Arch
9. Oxford Street - Vine to Hearst
10. Gilman Street - San Pablo to Hopkins

22

IMMEDIATE TRAFFIC ENGINEERING IMPROVEMENTS

LEGEND

16 PROJECT NUMBER
(See Pages 68 to 70)

NORTH

0 1 2 3 4 5 6

MAP SCALE IN THOUSANDS OF FEET

BERKELEY TRAFFICWAYS

Wilbur Smith and Associates

11. University Avenue - Fifth Street to Shattuck Avenue

12. Sixth Street - Hearst to Addison

13. Warring Street - Dwight to Derby

14. Derby Street - Warring to Belrose

15. Belrose-Claremont Blvd. - Derby to Claremont Ave.

16. Dwight Way - Tenth to Byron, Spaulding to Edwards, and at intersection approaches to Grove, Fulton, and Ellsworth Streets, Telegraph and College Avenues

17. Hopkins Street - Albina to Gilman

Prohibition of parking at all times

18. Thousand Oaks Boulevard - Colusa to The Alameda

19. Ashby Avenue - Domingo to East City Limit

20. College Avenue, at intersection approaches, between Stuart and Prince

21. Los Angeles Street, one side only, The Circle to Spruce

Prohibition of left-turns during peak hour

22. Shattuck Avenue onto Kittredge

23. Shattuck Avenue onto Center

Establishment of one-way streets

24. Bancroft, westbound, from Shattuck to Milvia

25. Durant, eastbound, from Milvia to Shattuck

26. Rose, westbound, from Spruce to Oxford

27. Vine, eastbound, from Oxford to Spruce

28. Spruce, northbound, from Vine to Rose

29. Oxford, southbound, from Rose to Vine

Change angle parking to parallel

30. Solano, West City Limits to The Alameda

The institution of these corrective measures will serve to relieve a substantial part of the congestion now found on trafficways in Berkeley. While these steps will not solve all of the traffic problems which now exist -- in a number of cases only new construction will accomplish this -- they will produce an immediate significant increase in the level of traffic service which should be adequate until further improvements, discussed in the following sections, are effected. To these engineering improvements should be added the prohibition of parking on hillside street segments where paving widths are inadequate to maintain two moving lanes. The City's Traffic Engineer will be aware of the locations where this action would be appropriate.

New Construction Needed by 1970 -- Between now and 1970 a number of new capital improvements should be made to the trafficways system of the City of Berkeley. These improvements are warranted by one or more of three factors, indicated below:

1) To eliminate existing congestion,
2) To correct existing deficiency in roadway conditions,
3) To provide for traffic requirements occasioned by increased traffic.

In effect, street projects recommended under the first two requirements are cited simply to correct existing deficiencies of alignment, capacity or repair. The third warrant for inclusion of a project in this phase is related in part to the fact that by 1970 the Bay Area Rapid Transit System will be in operation; the transit-oriented traffic will impose new and increased demands upon the streets serving the station areas. It is of prime importance that the necessary improvements be made prior to the opening of the transit operations so that construction operations do not conflict with the new station traffic.

In the following paragraphs the construction projects recommended for the period 1965-1970 (illustrated in Figure 23) are listed and discussed. A summary of the project costs is shown in Table 11. Cost estimates include right-of-way (where needed), normal grading, paving, curbs and gutters, normal changes to drainage, and sidewalks where necessary. Street lighting and landscaping, items which may fluctuate in relation to type of design, have not been included.

Hearst Avenue and Delaware St. -- The construction of the BARTD line north of University Avenue and the siting of the transit station at Sacramento Street will make possible the linking of Hearst Avenue and Delaware Street to form a continuous major street from Sixth Street to Gayley Road. This facility will provide needed relief for University Avenue and should be made as attractive as possible. Present plans now call for the development of Hearst as a divided street between Milvia and Sacramento; two 32-foot roadways, allowing for two travel lanes and one parallel parking lane in each direction, would be separated by a 36-foot median in which the aerial transit structure would be located. The cost of this improvement, exclusive of right-of-way, is estimated at $234,700. It is recommended that the 32-foot roadways be continued eastward to Shattuck Avenue; a 6-foot median (without left-turn bays) could be used to reduce the right-of-way requirement to 90 feet. The cost of this construction and right-of-way, estimated by the Department of Public Works, is $486,000. If, as has been suggested, the rapid transit line were to be underground as far as McGee Street, a 16-17 foot median would be used to separate the two roadways, rather than the wider median necessary if the transit line is aerial.

West of Sacramento Street the divided roadway should be continued for a short distance past Acton so that protected left-turn bays are available at both Acton and Sacramento. As adequate off-street passenger pick-up and parking areas are to be developed in conjunction with the BARTD station, curb parking is not essential on this section. Thus a dual 24-foot roadway design, which can be fitted into the existing right-of-way, is recommended. After a transition section west of Acton, a 48-foot

23

CAPITAL IMPROVEMENT PROGRAM

LEGEND

FIRST PHASE
IMPROVEMENTS NEEDED BY 1970

SECOND PHASE
IMPROVEMENTS NEEDED BY 1980

NORTH

0 1 2 3 4 5 6

MAP SCALE IN THOUSANDS OF FEET

BERKELEY TRAFFICWAYS

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Table 11

CAPITAL IMPROVEMENTS NEEDED BY 1970
Berkeley Trafficways Study

STREET	LIMITS	COST	REMARKS
Acton St.	Cedar-University	$ 90,900	Widen to 40'
Adeline St.	Alcatraz-Woolsey	107,600	Divided 44' roadways
	Woolsey-Ashby	61,100	See Figure 14
	Ashby-Ward	86,150	Divided 36' roadways
	Grove-South City Limit	64,700	Intersection redesign & reconst'n.
Alcatraz Ave.	Essex-Sacramento	55,600	Widen to 44'
Allston Way	Shattuck-Oxford	28,900	Widen to 40'
	Sacramento-Sixth	196,600	Widen to 40'
Allston-Second St.	University-Sixth	149,300	New 48' rdwy. & widening to 48'
Arlington Ave.	North City Limit-The Circle	418,600	Widening and reconstruction
Ashby Ave.	Shattuck-Ellis	1,419,200	Dual 24's and 48'
California St.	-	8,000	Install diverters
Delaware St.	Sacramento-Sixth	210,500	Dual 24's and 48'
	Sixth-Fifth	17,200	Widen to 48'
Del Norte St.	Sutter-The Circle	25,000	Widen to 40'
Dwight-Haste Conn.	Grove-Grant	377,800	New 44' roadway
Ellsworth St.	Bancroft-Ashby	241,000	Widen to 44'
Euclid Ave.	Hearst-Cedar	71,900	Widen to 40'
Fulton St.	Bancroft-Durant	200,300	Widen to 84'
	Durant-Ashby	241,100	Widen to 44'
Gayley Rd.	Hearst-Bancroft	142,300	Widen to 48'
Gilman-Sacramento	Hopkins-Rose	550,000	New connections
Glendale St.	Intersection at La Loma	32,000	Intersection redesign
Grove St.	South City Limit-Alcatraz	87,100	Divided 42' roadways
	Adeline-Ashby	72,000	See Figure 14
	Ashby-Stuart	78,500	Widen to 64'
Hearst Ave.	East Frontage Rd.-Fifth	72,000	Widen to 48'

Table 11 (Cont.)

CAPITAL IMPROVEMENTS NEEDED BY 1970
Berkeley Trafficways Study

STREET	LIMITS	COST	REMARKS
Hearst Ave.	Arch-Euclid	$ 51,200	Reconstruction and widening
	Euclid-Highland	97,000	Widen to 44'
	Milvia-Shattuck	486,000	Divided 32' roadways
	Sacramento-Milvia	234,700*	Divided 32' roadways
Hopkins St.	Gilman-Monterey	39,700	Widen to 40'
La Loma Ave.	Hearst-Le Conte	32,200	Widen to 40'
Le Conte Ave.	Hearst-La Loma	96,200	Widen to 40'
Ridge Rd.	Le Conte-La Loma	65,100	Widen to 40'
Sacramento St.	Oregon-South City Limits	176,800	Divided 36' roadways
Shattuck Ave.	Ward-University	341,100	Divided 46' roadways
Shattuck Ave. Ext.	University-Berkeley Way	270,000	New 36' roadway
Telegraph Ave.	Bancroft-Dwight	29,700	Reconstruction
	Parallel facility	2,580,250	New 40' roadway
University Ave.	Marina Blvd.-Eastshore Fwy.	165,000	Divided 32' roadway
	Fifth-Grove	459,300	Divided 32' roadways
	Grove-Oxford	140,700	Divided 32' roadways
Woolsey St.	Shattuck-Grove	28,000	Reconstruction
TOTAL IMPROVEMENT COST		$10,390,300	

*Does not include r/w costs to be borne by BARTD.

roadway, allowing for either four moving lanes or two moving and two parking lanes, will be adequate.

The cost of improving Delaware as indicated (Sacramento to Sixth Street), including rebuilding pavement west of Acton, is estimated at $210,500. This figure includes the cost of new traffic signal installations recommended at the intersections of Delaware with Sixth, San Pablo, and Sacramento Streets. A fourth signal installation, at Acton, may be necessary in a later stage and necessary electrical conduit should be installed at this time.

Hopkins-Gilman-Sacramento -- The redesign of the intersection of these streets, discussed in detail in the preceding chapter, should also be undertaken so as to be in operation by the beginning date of BARTD operation. The total estimated cost of $550,000 for the extension of Gilman and the construction of the Sacramento-Monterey connection includes $432,500 for right-of-way, $96,500 for construction, and $21,000 for basic traffic signals at the intersections of Gilman at Sacramento, and Hopkins at Monterey and Hopkins at Gilman. Cost of interconnected actuated signals at these locations would total approximately $60,000. Widening of Hopkins (Monterey to Gilman) to 40 feet is recommended; this would add an additional $39,700 to the cost of the project, bringing the total to $589,700.

Acton Street -- The operation of the Sacramento Street station will induce more traffic use of Acton Street, between University Avenue and Cedar Street. It is therefore recommended that this street be widened to 40 feet and resurfaced. In addition, curb corners at Delaware should be clipped to improve the off-set intersection. The total cost of this project is estimated at approximately $90,900.

California Street -- Accident statistics indicate that the use of California Street as a trafficway is producing an unnecessarily hazardous situation. Although the paving on this street is less adequate than that present on Sacramento, one block to the west, its straight alignment and the presence of a traffic signal (which facilitates movement at the only spot of real congestion) at University encourages

its use as a collector street.

It is recommended that traffic diverters such as those in use on Russell Street be installed at appropriate locations (to be determined by the Planning and Public Works Department) to make California Street discontinuous. A cost of $8,000 is estimated for this construction. Following this revision, it is likely that the traffic signal at University Avenue could be removed.

Grove Street-Adeline-Shattuck -- South of Alcatraz Avenue, Grove is to be widened to a dual 42-foot section as noted in Chapter V. The divided roadways are to be separated by a median containing the transit line. Construction of the new roadway and reconstruction of the old is estimated to cost $87,100, exclusive of right-of-way estimated at $15,000. As indicated earlier, between Alcatraz and Ward, the divided roadways should be 36 feet in width, except in the area adjacent to the Ashby station, where a specialized section has been proposed. Much of this paving is now in poor condition and will require reconstruction in the near future. The cost of this section is estimated to be approximately $254,850; no additional right-of-way should be required. From Ward to University 46-foot divided roadways, with transit in the median, will provide adequate capacity for parking as well as moving lanes. No additional right-of-way will be required on Shattuck between University Avenue and Ward. The cost of the recommended widening and reconstruction for the route from Ward to University Avenue is estimated at $341,100.

In addition to the recommended changes in paving, certain operational changes will also be necessary because of the increase in traffic volumes. All curb parking should be changed from angle to parallel to increase the traffic capacity of the street and to reduce the accident potential. In the vicinity of University Avenue, the recommended 46-foot roadways will allow for three travel lanes plus a fourth lane for buses and parking. During off-peak hours most of the bus lane will be available for curb parking.

South of Durant, the curb lane (excluding the necessary bus zones) can be used for parking at all times.

Shattuck Avenue Extension -- The proposed extension of 'East' Shattuck Avenue north to connect with the divided roadways in the vicinity of Berkeley Way, described in the preceding chapter, should be implemented prior to the opening of the Berkeley Station. As indicated earlier, this extension should have a most beneficial effect on the operational characteristics, not only of the Shattuck-University intersection, but also on a number of other streets in the downtown area. This project is currently scheduled for the period 1966-1968; its cost is estimated to be approximately $270,000.

Grove Street -- Between Adeline Street and Ashby Avenue, Grove Street will serve both as a major street providing cross-city traffic service to the residents of Berkeley and as a primary access road for the Ashby Avenue station of the BARTD. In this 1,400-foot section, the typical cross section for other parts of Grove (north of Adeline) will not be appropriate. For this portion of Grove the paving section illustrated in Figure 14 has been recommended.

From transit patronage data furnished by the Transit District's engineers, the northbound evening peak-hour volume on Grove (south of Ashby) has been estimated to increase from 570 vehicles per hour (1964) to 1,370 vehicles per hour (Peak Design Day, 1975). If this volume is to be carried efficiently, a high-quality traffic facility must be provided. Thus, south of Ashby Avenue a five-lane, divided roadway is recommended. Three travel lanes northbound and two travel and one parking lane would be provided southbound. No openings would be allowed in the median between Ashby and Woolsey -- both of which intersections would be signalized. A left-turn lane (from the south) with adequate storage will be necessary at Ashby; the estimate of more than 300 left-turning vehicles from Grove onto Ashby during the P. M. peak hour suggests that left-turns be permitted from two lanes during the evening peak hour. The right-turning movement also is sufficiently heavy to warrant a separate lane (see Figure 14). The project cost for this section is estimated at $72,000.

North of Ashby Avenue the 64-foot section discussed in the preceding chapter should be completed for a distance so that traffic operations at the station site are not disrupted by later construction activity. Stuart Street is suggested as a reasonable terminal point for this stage. This cost is estimated at approximately $78,550.

University Avenue -- The construction of the dual 32-foot roadways planned for University Avenue (see Chapter V) will cause problems around the Berkeley station area if done after the transit system is in operation. It is therefore recommended that the segment between Grove and Oxford be completed prior to that time. The cost of this section is estimated to be approximately $140,700.

Allston Way -- The single block of Allston, between Shattuck and Oxford, should be widened to 40 feet prior to the beginning of BARTD operation. This is estimated to cost approximately $28,900. As only 55 feet of right-of-way are present for this one-block length of Allston, the sidewalks will be only 7.5 feet wide, rather than the recommended 10-foot minimum. It is believed that, in this case, the requirements of vehicular traffic are sufficient to require this departure from normal practice.

Woolsey Street -- It is recommended that Woolsey Street be designated a collector street from Shattuck Avenue to Grove Street and that the pavement should be rebuilt to meet the demands which will be placed upon it. The existing 42-foot pavement width is deemed adequate. Reconstruction costs are estimated at $28,000.

Ashby Avenue -- The improvement of Ashby Avenue in the vicinity of the rapid transit station will be of prime importance. It is essential that Ashby be widened to the full six lanes recommended between Grove and Adeline; a transition section at either end of this project will also be necessary. For the purpose of estimating costs, project limits of Ellis Street and Shattuck Avenue are shown; the cost of this project is approximately $1,419,200. Because of the large number of properties to be acquired and the extreme importance of this connection, acquisition should be started immediately.

Summary of Pre-Transit Projects -- All of the preceding projects are needed prior to the beginning of BARTD operation. The total cost of these projects is approximately $4,280,000. Other projects which will be needed by the year 1970 are detailed in the following paragraphs.

Arlington Avenue -- The Arlington, for the most part a dual roadway major north-south arterial connecting Berkeley with the hill areas of Kensington, Albany, El Cerrito, and Richmond, is presently carrying volumes of 9,000 to 12,500 vehicles per day. The roadways are in poor condition because movements in the base have caused deformation of the road surfaces. Also, in the areas where roadway widths are only 18 feet, the combination of permitted curb parking and inadequate bus zones causes severe restriction in the traffic capacity of the street.

To correct these deficiencies and to provide for increased future demands, it is recommended that, where divided roadways are present, they be widened to 24 feet to allow for a full travel lane and a full-sized parking/bus loading lane. In addition, the existing paving, where of an adequate width, should be reconstructed to give a better surface. The cost of these improvements (exclusive of major grading and other earth work) for the distance from the north city limit to The Circle is estimated at $218,600. The estimation of the earth work necessary for this project must await preparation of detailed plans and soil tests. Although it is impossible to make an informed estimate of the cost of this work until this time, it is apparent that this cost will be quite significant. A first-order estimate of $200,000 has been made to give some idea of the cost which might be expected.

Adeline Street -- With the development of Grove Street as a 6-lane, divided street, it is expected that Adeline will lose much of its importance as a major artery south of Alcatraz Avenue. For this reason the intersection of Adeline at Grove-Adeline should be redesigned to make a T-intersection with the Grove/Grove-Adeline movement favored (see Figure 24). North of Alcatraz the paving of Adeline must be reconstructed to improve the surface condition of the street. The cost of the recommended construction

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FUNCTIONAL DESIGN - ADELINE ST. AT GROVE ST.

BERKELEY TRAFFICWAYS
Wilbur Smith and Associates

is estimated at $64,700.

<u>Alcatraz Avenue</u> -- Paving is not adequate, and it is recommended that the street west of Sacramento Street be widened to 44 feet. A cost of $55,600 is estimated for this project.

<u>Allston Way</u> -- The designation of Allston Way as a collector street in the trafficways system will require that the street be widened to support increased volumes of traffic. Three sections of improvement are recommended in this phase. The widening of Allston between Shattuck and Oxford was discussed earlier in this chapter. A second section, from Sixth Street to Sacramento, should also be widened from 36 to 40 feet. The cost of this segment is estimated at $796,600. Included in this section is the realignment of the existing jog at the A.T. & S.F. R.R.. Right-of-way costs for this have been estimated at approximately $25,000.

The final section recommended in this stage is the establishment of a new connection from the Eastshore Freeway to Allston Way, via Second Street. This connection would give a possible alternate to University Avenue and would, at the same time, provide better access to Aquatic Park. The cost of this project is estimated to be $149,300 (University to Sixth).

<u>University Avenue</u> -- The remaining segment of University Avenue west of Grove should be completed and in operation by 1970. As indicated previously, University Avenue is now carrying volumes near or in excess of its practical capacity; by 1980, even with the improvement of Hearst and Allston as supplementary routes and the assumed provision of new connections to the freeways, it will be required to carry greater loads. For this reason alone the recommended improvement of University Avenue should be undertaken soon. The desire of the City to have the street improvements and beautification completed for the centennial of the University of California in 1968 also provides a strong reason for the early beginning of work on this project. It is estimated that street construction for the section between Sixth and Grove Street will cost approximately $459,300.

It should be noted that the presence of diagonal parking on University contributes materially to the congestion now found on this important major street. For this reason, if the recommended widening is not initiated within a very short time, the prohibition of parking during the morning and afternoon peak hours will become imperative.

A second segment of University Avenue is also recommended for this stage -- the construction of a new, high quality 4-lane roadway from the Eastshore Freeway to the Berkeley Marina. The cost of this project has been estimated at $150,000.

Sacramento Street -- South of Oregon St., Sacramento Street is in poor condition and needs attention to prevent the further deterioration of the paving. In this area two 40-foot roadways, divided by a median which is devoted to the Santa Fe Railroad line, traverse a busy strip commercial area. It is recommended that in the process of reconstructing the paving, consideration be given the use of 36-foot roadways and that the additional land be devoted to widened sidewalks and planting strips through the area. Coordination of this project with the Planning Department and the persons working with the Neighborhood Improvement Programs would appear to be necessary to establish exact design criteria. For the basis of estimating costs, reconstruction of the existing paving to the narrower cross-section, new curbs and relocated catch basins were assumed. These indicate a project cost of approximately $176,800.

Fulton-Ellsworth -- As indicated in the previous chapter, the widening of this existing one-way couplet to provide 44-foot roadways is recommended. The cost of these combined widenings is estimated at $482,100. The widening of Fulton between Durant and Bancroft to allow two-way operation will require an additional $200,300.

Telegraph Avenue -- Various possible treatments of Telegraph Avenue in the area between

Bancroft and Dwight Ways were discussed in the Traffic and Parking Study -- Berkeley South Campus Urban Renewal Area, Second Phase[1]. That study recommended a new street, some 200 feet to the west, be developed to function as a one-way street in conjunction with the existing Telegraph Avenue. This plan, considered to be the most efficient and desirable course of action, was estimated to cost approximately 2.6 million, including the resurfacing of Telegraph Avenue.

South of Dwight Way, revision of the pavement cross-section will be necessary but can be deferred until the last phase of activity, as described on page 87.

Hearst-Delaware -- Between Euclid and La Loma, Hearst is planned to be widened to 44 feet at a cost of $97,000. One further segment of Hearst in the hill area north of the campus will remain to be improved in this stage, the section from Arch to Euclid. A plan developed by the City Public Works Department and approved by the City Council for the widening of Hearst in this section, to provide four moving lanes, should be carried out. The cost of this project, which will require no additional right-of-way, is estimated at approximately $51,200.

At the western end of the city, the section from the East Frontage Road to Fifth Street, which will serve as a collector street in the West Berkeley Industrial Park, should be widened to 48 feet. The cost of this project is estimated at $72,000.

The short segment of Delaware Street from Fifth to Sixth Street should be widened to 48 feet to provide access to the West Berkeley Industrial Park. The estimated cost of $18,000 will also provide for a complete reconstruction of the existing paving.

Ridge Road -- The paving on Ridge Road, between Le Conte and La Loma Avenues, is only 36 feet in width -- inadequate for its function as a collector street in the Northside area. In addition, recent construction activity requiring the use of heavy equipment has accelerated the deterioration of

[1] Wilbur Smith & Associates, 1964.

the paving. It is recommended that this street be widened to 40 feet and rebuilt so that it can function properly with two travel and two parking lanes. The cost of the recommended project is estimated to be approximately $65,100.

Le Conte Avenue -- The improvement of Le Conte between Hearst and La Loma by widening to 40 feet and resurfacing should be done to allow this street to function as an adequate collector street. The cost of the project is estimated at $96,200.

Del Norte Street -- Del Norte, which serves as the access route from Hopkins and Sutter to The Circle and the hill area streets which collect at this terminal, is presently scheduled for reconstruction in the 1965-'66 program. The street should also be widened to 40 feet to allow at least two travel lanes and two optional curb parking lanes. The cost of this project has been estimated at $25,000.

Dwight Way-Haste Street Connection -- The recommended connection of Dwight Way and Haste, discussed in Chapter V, is recommended for early implementation. The estimated cost of this project is $377,800.

Gayley Road -- Gayley Road, which passes through the University of California campus, connecting Hearst with Bancroft, should be widened to give four lanes of travelway. The 60-foot restriction on right-of-way will require that a simple 48-foot paving section be used. The cost is estimated to be $142,300. This street is effectively a private street by virtue of the fact that no right-of-way has been dedicated to the public by the Regents of the University of California. However, an agreement between the University and the City indicating the willingness of the Regents to have this street used by the public is in effect, and the recommended widening is possible when adequate capacity has been provided to the north and south of the campus property lines.

La Loma Avenue -- To provide an adequate connection between Hearst and Le Conte, it is recom-

mended that La Loma be widened to 40 feet and reconstructed. This is estimated to cost approximately $32,200.

Euclid Avenue --- This north-south street should be reclassified as an arterial street and rebuilt so as to accommodate the traffic which it carries. Widening to 40 feet and reconstruction between Hearst and Cedar is estimated at $71,900.

Glendale at La Loma -- The elimination of this "switchback" will greatly improve the character of this collector street. The project is estimated by the Department of Public Works to cost $32,000.

Improvements Needed by 1980

In this section the remaining improvements needed by the year 1980 are detailed and discussed. Included in this list are not only street widening projects needed to provide additional capacity, but also reconstruction projects needed to repair streets of adequate size which are in poor repair or are anticipated to be so by 1980. The projects are summarized in Table 12 and their locations also illustrated in Figure 22, along with the first phase program.

Ashby Avenue -- As indicated in Chapter V, the existing Ashby Avenue roadway is not adequate for 1964 traffic volumes and will require major improvements prior to 1980 to meet future demands. While the removal of parking during peak-hours, suggested earlier, will provide some measure of relief, growth in traffic will require that more than the existing four substandard lanes be developed. It is probable that in some sections (particularly between San Pablo and Adeline) parking will have to be prohibited at all times as volumes increase. It is, therefore, recommended that the remaining widening to dual 36-foot roadways, discussed in Chapter IV, be implemented as soon as possible. (This recommendation recognizes the need for a freeway in this corridor, but goes on the assumption that City policy will continue to oppose such a freeway). Because of the magnitude of this project, it is suggested that initial activity be concentrated on the acquisition of right-of-way so that these

Table 12

CAPITAL IMPROVEMENTS NEEDED BY 1980
Berkeley Trafficways Study

STREET	LIMITS	COST	REMARKS
Alameda, The	Solano-Hopkins	$ 85,300	Reconstruction
	Thousand Oaks-Solano	57,500	Reconstruction
Alcatraz Ave.	Sacramento-Dover	98,100	Widen to 44'
	College-Claremont	30,000	Widen to 44'
Allston Way	Sacramento-Shattuck	166,300	Widen to 44'
Ashby Ave.-Tunnel Rd.	Eastshore Fwy.-Ellis Ellis-E. City Limit	7,422,000	Divided 36' roadways
Cedar St.	Marina Blvd.-Eastshore Fwy.	178,500	New 48' roadway
	Eastshore Fwy.-Sacramento	936,400	Widen to 44'; R.R. grade separation
	Sacramento-La Loma	368,200	Widen to 44'
College Ave.	Bancroft-South City Limit	300,000	Widen to 44'
Colusa Ave.	North City Limit-Catalina	69,800	Reconstruction
	Catalina-Marin	228,200	Eliminate off-set & reconstruction
Derby St.	Sacramento-Warring	300,000	Widen to 40'
Durant Ave.	Shattuck-Piedmont	135,800	Reconstruction
Dwight Way	Shoreline Fwy.-S.P.R.R.	4,500,000	Structure
	S.P.R.R.-Grant	2,240,800	Divided 36' roadways
	Grant-Shattuck	49,700	Widen to 44'
	Shattuck-Telegraph	117,300	Widen to 44'
	Telegraph-Piedmont	133,100	Widen to 44'
	Piedmont-East City Limit	40,000	New 40' roadway (City of Berkeley share)
Euclid Ave.	Cedar-Grizzly Peak	296,000	Reconstruction
Gilman St.	Marina Blvd.-Eastshore Fwy.	264,000	New 48' roadway
	Eastshore Fwy.-San Pablo	894,300	48' roadway, R.R. grade separation
	San Pablo-Hopkins	179,000	Widen to 44'
Grove St.	Hopkins-Stuart	2,422,200	Widen to 64'

Table 12 (Cont.)

CAPITAL IMPROVEMENTS NEEDED BY 1980
Berkeley Trafficways Study

STREET	LIMITS	COST	REMARKS
Haste St.	Grove-Piedmont	73,400	Widen to 44'
Hopkins St.	Carlotta-Sutter	124,500	Reconstruction
	Gilman-San Pablo	108,300	Reconstruction to 40' width
Keith Ave.	Spruce-Shasta	74,800	Reconstruction
La Loma Ave.	Cedar-Buena Vista	14,500	Reconstruction
Marin Ave.	West City Limit-The Alameda	61,700	Reconstruction
Marina Blvd.	University-Gilman	264,400	New 48' roadway
Milvia St.	Dwight-Channing	40,000	Widen to 40'
	Center-Cedar	129,300	Widen to 44'
Oxford St.	Virginia-Rose	95,500	Widen to 44'
Piedmont-Warring-Derby-Belrose-Claremont Rd.Rte.	Bancroft-Claremont Ave.	162,300	Reconstruct Piedmont and Warring; widen others to 44'
Glendale-Delmar-Campus-Queens-Avenida	La Loma-Grizzly Peak	52,300	Widen to 32'
Glendale-Campus	La Loma-Shasta	49,200	Widen to 32'
Sacramento St.	Dwight-University	161,800	Divided 33' roadways
Santa Fe Ave.	North City Limit-Gilman	75,000	Widen to 40'
Seventh St.	Dwight-Ashby	168,000	Widen to 48'
Shasta Rd.	Keith-Grizzly Peak	93,200	Reconstruct to 40'
	Grizzly Peak-Tilden Park Gate	10,000	Widen and reconstruct
Solano Ave.	W. City Limit-Alameda	62,000	Reconstruction
Spruce	Vine-Eunice	95,500	Widen to 44'
	Eunice-Marin	94,300	Widen to 40'
	Marin-Grizzly Peak	111,000	Reconstruct to 36'
Telegraph Ave.	Dwight-South City Limit	302,300	Divided 33' roadways
Thousand Oaks Blvd.	Colusa-Arlington	42,300	Reconstruction
TOTAL IMPROVEMENT COST		$23,978,000	

costs do not increase further through the appreciation of land values. If plan lines were established, coordination with the building permits section of the Public Works Department should ensure that no additional improvements be allowed on properties slated for acquisition. This project will also require the cooperation of other City departments and civic groups to soften the effects of relocating the families and businesses which will be displaced by the project.

Seventh Street -- As noted in Chapter V, the paving of Seventh Street between Dwight Way and Ashby Avenue varies between 43 and 46 feet in width. It is desirable to widen this to 48 feet, matching the section to the north, because of the heavy volumes of commercial vehicles which now use and will continue to use this route. The cost of the necessary widening is estimated to be $168,000.

Sacramento Street -- Sacramento Street should be rebuilt from Dwight Way to University Ave. to give two 33-foot roadways, providing for two moving and one conventional parking lane in each direction; this project is estimated to cost $161,800.

Milvia Street -- It is recommended that the improvement of Milvia Street as a collector street between Cedar and Dwight Way be completed. From Center Street to Cedar a 44-foot cross-section is proposed; from Channing Way to Dwight Way a 40-foot section is recommended. Costs for the two sections recommended are as follows:

Dwight Way to Channing Way	$ 40,000
Center Street to Cedar Street	$129,200

From the point of view of geometrics, it would be desirable to eliminate the off-set intersection at University Avenue. However, the recommended improvement of Grove Street should bring about a significant decrease in congestion at this intersection, deferring the need for this improvement estimated to cost in excess of $160,000.

La Loma Avenue -- Because of the restrictions imposed by the right-of-way and topography, and because of the character of the abutting property, no widening of La Loma between Cedar and Buena Vista is proposed. The existing 32-foot paving section, which can accommodate two travel and one parking lane, should be rebuilt at an estimated cost of $14,500.

Telegraph Avenue -- At present the condition of the pavement on Telegraph south of Dwight Way is classed as fair to good. It is recommended that this street be rebuilt along the same lines as Oxford Street -- with dual 33-foot roadways separated by a landscaped median with left-turn bays. This section would provide somewhat greater capacity with a greatly enhanced appearance and reduced hazard. The cost of this project is estimated to be $302,300.

College Avenue -- For College Avenue to function well as a collector street in the intensively developed area through which it runs, it would be desirable for it to be widened to 44 feet. This dimension would allow for the use of the curb lane as a good travel lane for peak-hour volumes. No additional right-of-way will be necessary. Construction costs of $300,000 are estimated for the widening of the entire length of College, between Bancroft Way and the city limit south of Alcatraz Avenue.

Grove Street - The widening of Grove to a 64-foot, four lane street between Stuart and Hopkins as discussed in Chapter V is recommended for this time period. As is the case with Ashby Avenue and Dwight Way, the need to acquire a large amount of right-of-way will require close coordination with other City departments to ensure that the property is obtained at the most reasonable price and that the relocation of families and businesses does not cause unnecessary hardship.

The cost of widening Grove between Hopkins Street and Stuart is estimated at $2,422,200. The reconstruction of The Alameda between Solano and Hopkins, estimated at $85,000, is also included in this stage.

Piedmont-Warring-Derby-Belrose-Claremont Road -- This route should be improved as indicated in Chapter V to provide four lanes for peak-hour movement. The cost of the necessary widening and reconstruction is estimated to be $162,300.

Gilman Street -- 1964 volumes on Gilman between the Eastshore Freeway and San Pablo Avenue ranged from 10,000 to 12,850 vehicles per day. Between Sixth Street and San Pablo the street was operating with volumes over its practical capacity. The paving, which is 48 feet wide, is in poor condition. Thus the improvements must solve both the problem of insufficient traffic capacity and that of physical deterioration.

In the recommended trafficways plan, the new connection of Cedar Street to the proposed Shoreline Freeway can be expected to materially diminish the problem of increasing congestion on Gilman Street. Estimates of 1980 Gilman Street traffic volumes made with this freeway connection on Cedar assumed are only slightly higher than those found in 1964. However, since the relief provided by this connection is not anticipated until near the year 1980, certain improvements will be necessary in the meantime. Two options are open. First, Gilman could be widened to 64 feet between San Pablo and the freeway, to provide four moving and two parking lanes. Alternatively, peak-hour curb-parking restrictions could be instituted to provide the necessary peak-hour capacity until the connection of Cedar and the freeway is made; the existing 48-foot paving would simply be rebuilt within the existing curbs. In either case a 4-lane grade separation should be constructed at the Southern Pacific main line.

Of the two alternatives, the second is recommended. The character of development on Gilman is not such as would be severely hampered by the removal of curb parking during the peak hours. This approach will also cost considerably less than the widening and will serve as well. The cost of the recommended project is approximately $894,300, including the grade separation.

A 44-foot paving section will be feasible in the area between San Pablo Avenue and Hopkins Street. This cross-section will provide two travel lanes and two curb parking lanes; during periods of peak demand the prohibition of parking will allow for two additional moving lanes. The cost of the recommended project, which will require no additional right-of-way, has been estimated at $179,000.

Hopkins Street -- The paving on Hopkins Street between Monterey and Sutter is presently in very bad condition and should be replaced as soon as possible. This reconstruction, estimated to cost approximately $124,500, is presently in the 1966-'67 program of the City. Because of the relatively low priority placed upon this street by the sufficiency rating and the heavy expenditures recommended in the first two stages, it is recommended that the reconstruction of Hopkins be deferred until the later stages of this program. Reconstruction between Gilman and San Pablo, with widening where necessary to give a 40-foot roadway, is also recommended. This cost is estimated at $108,300.

Cedar Street -- It is recommended that Cedar Street be widened from its present 36-foot width to 44 feet between the East Frontage Road and Sacramento Street to better serve as a major east-west street. The 60-foot right-of-way is adequate for the recommended section with the exception of one block between Acton and Sacramento, where five additional feet of right-of-way will be required from each side of the street. As with Gilman, a grade separation (underpass) is recommended to eliminate auto-train conflicts at the Southern Pacific crossing at Third Street. The total cost of the project, including the underpass, is estimated at $936,400.

Two other projects will be required on Cedar Street later in the period 1970-'80. The first of these will be the construction of the grade separation structure over the Eastshore Freeway to provide connection with the proposed Shoreline Freeway. It is assumed that the cost of this will be borne by the Division of Highways. The extension of Cedar to Marina Boulevard is estimated at $178,500.

The second area of work on Cedar is the section from Sacramento to La Loma. Although portions of this street (from Sacramento to Grove) were recently widened to 40 feet from the old 36-foot section, the projected volumes of up to 13,500 vehicles per day indicate that some congestion will be apparent if no further improvements are made. Therefore it is recommended that widening to a 44-foot section, within the existing right-of-way, be made by 1980. The cost of this project is estimated at $368,200.

Allston Way -- The widening of Allston Way between Sacramento and Shattuck Avenue is recommended, to produce a 44-foot cross-section. The cost of this project is estimated at $166,300.

Durant Avenue -- Due to the poor condition of the paving on Durant Avenue, reconstruction within the existing curbs will certainly be necessary prior to 1980. A cost of $135,800 is estimated for the section from Shattuck Avenue to Piedmont Avenue.

Haste Street -- As indicated in Chapter V, it is recommended that one-way streets be developed to a 44-foot width to provide for the use of a third moving lane during peak periods. For this reason it is recommended that Haste Street be widened from 40 to 44 feet throughout its entire length. The cost of this project is estimated at $73,400.

Dwight Way -- As with Haste (above), it is recommended that Dwight Way also be widened to give a 44-foot paving section from Grant to Piedmont. The present 40-foot paving section is adequate for two travel lanes and two parking lanes as now marked; the recommended widening will allow three full moving lanes with peak-hour parking restrictions on one side. The widening project will cost approximately $300,100. In addition, the proposed extension of Dwight Way eastward to provide alternate access to Panoramic Hill has been included in the program; the cost of this is estimated at $200,000. The City of Berkeley's share of this is $40,000.

Until a Shoreline freeway is constructed and a connection with Dwight Way effected, traffic volumes on Dwight Way will continue to increase at a moderate rate from the levels now found. For

this reason, Dwight should continue to function (with the recommended curb parking prohibitions) for five or more years without recommended widening. However, as right-of-way necessary for widening to six lanes plus median will become more expensive as time passes, it is recommended that acquisition be instituted soon. The total cost of the widening of Dwight Way, from Seventh Street to Grant, is estimated at $2,037,700. At a later stage, when the location of the Shoreline Freeway has been determined, the widening of Dwight between Seventh Street and the freeway to give six lanes is also recommended. The cost of this, exclusive of the structure for the connection, is estimated at approximately $203,200. If it is determined that no connection to the new freeway will be provided, volumes on Dwight Way will be lower than projected and the divided 36-foot roadways will not be appropriate. A 64-foot roadway, such as that recommended for Grove Street, would be adequate in this eventuality.

Derby Street -- With the advent of the rapid transit line in the center of Shattuck Avenue, the streets parallel to Derby which now cross Shattuck -- Ward, Blake, Parker, and Carleton Streets -- will no longer provide for east-west movements across Shattuck. This will result in a concentration of traffic on other streets. By its location Derby appears to be the street most subject to this diversion. It is recommended that Derby be widened to 40 feet between Warring and Sacramento. (Those sections, such as from Shattuck to Grove, which are presently 42 feet wide, would simply be reconstructed within the existing curbs.) The cost of the recommended improvement is estimated at $300,000. This should provide a good secondary street connecting Sacramento and Warring Streets.

Alcatraz Avenue -- Two widening projects will be required to complete the upgrading of Alcatraz as a major street within Berkeley. These are the sections from the east city limit to Sacramento and from College to Claremont Avenue. A 44-foot cross-section is recommended for both sections. Their cost is estimated at $98,100 and $30,000, respectively. Because much of Alcatraz Avenue lies within the City of Oakland, coordination of improvements between the two cities would be most desirable.

Santa Fe Avenue -- This collector street is now grossly inadequate in terms of both right-of-way and paving. The acquisition of land by the BARTD will allow the widening to a 40-foot section from the north city limit to Gilman Street. The cost of this short project, which will connect with adequate facilities on Santa Fe, Masonic, and Key Route Boulevard in Albany, is estimated at $75,000.

Spruce-Oxford -- The planned improvement for the Spruce-Oxford complex is detailed in Chapter V. To implement this improvement it will be necessary to widen Oxford to 44 feet (Virginia to Rose), widen Spruce to 44 feet (Vine to Eunice), and to 40 feet (Eunice to Marin). Between Marin and Grizzly Peak Road the existing 36-foot wide pavement on Spruce is quite adequate for the 5,000 to 6,500 vehicles per day projected for 1980. However, because this paving is in poor condition, it will require reconstruction. The cost of these improvements is estimated to total $396,300.

Colusa Avenue -- As indicated previously, the jogged intersection of Colusa with Solano Avenue should be corrected and new paving constructed to provide a continuous alignment. The cost of this project, together with necessary reconstruction from Catalina to Marin, is estimated at $228,200.

By 1980 it is probable that the paving of Colusa north of Catalina to the city limit will require reconstruction. The existing 36-foot cross-section will, with peak-hour, peak-direction parking prohibitions, be adequate for the projected volumes of 7,000 to 8,000 vehicles per day. The recommended reconstruction is estimated to cost approximately $69,800.

Thousand Oaks Boulevard -- Thousand Oaks will also require reconstruction by 1980 to improve the poor surface condition now existing. As indicated earlier, the removal of parking from this street is considered a more appropriate action than widening of the street. The cost of reconstructing Thousand Oaks, from Colusa to The Arlington, within the present curbs, is estimated to be $42,300.

The Alameda -- It will also be necessary to reconstruct The Alameda, between Thousand Oaks Boulevard and Solano Avenue, by 1980. No widening is recommended. Cost of the project is estimated

at $57,500.

Solano Avenue -- The paving condition on Solano between the city limit and The Alameda is now rated as fair and will require reconstruction prior to the year 1980. The 64-foot cross-section now in place is adequate for the projected traffic volumes. It is recommended that the City of Berkeley confer with the City of Albany, which is now preparing to study the possible upgrading of the Solano Avenue shopping strip in that city, to develop a plan for the development of the street in both cities. One of the more important elements which should receive special consideration is that of parking. It is estimated that repaving the Berkeley portion of the street would cost approximately $62,000.

Marin Avenue -- The recent development of a direct connection from Marin Avenue to the Eastshore Freeway via Buchanan Street in Albany has reinforced the importance of this major east-west street. Its 60-foot paving section is quite adequate for the volume of traffic projected for it; however, the paving is in presently fair condition and will have to be replaced. The cost of this reconstruction is estimated at $61,700.

Euclid Avenue -- To accommodate the projected traffic volumes of 7,000 to 9,000 vehicles per day, it is recommended that Euclid be widened to 40 feet from Cedar Street to Eunice Street. North of this point the volumes will drop to 6,300 vehicles per day or less and can be accommodated on the existing cross-section. However, the paving is in poor condition and should be reconstructed prior to the year 1980. The cost of the entire project, from Cedar Street to Grizzly Peak Boulevard, is estimated at $296,000.

Glendale-Delmare-Campus-Queen's-Avenida -- This hillside collector route will require reconstruction and widening to 32 feet by 1980. A cost of $101,500 has been estimated for this work. No widening of the existing section (which varies from 24 to 26 feet in width) is recommended.

Shasta Road-Keith Avenue -- This hillside collector route will also require reconstruction and widening to a minimum 32-foot section by 1980. A cost of $168,100 has been estimated for repaving the section from Spruce to Grizzly Peak Boulevard.

Waterfront Area Trafficways -- As indicated in Chapter V, only the most general estimates can be made at this time for the cost of construction of the major streets in the Marina area. Based on the probable construction of four-lane streets, approximately $706,900 will be required for the construction of Marina Boulevard, Cedar Street (Marina to Eastshore Freeway), and Gilman Street (Eastshore Freeway to Marina).

Summary of Recommended Improvements

Summarized in the preceding pages are the improvements necessary to assure that an adequate trafficways system will be available in 1980. It is estimated that capital expenditures in the order of $34.4 million will be required to implement this program. A small part of this sum will be borne by the Bay Area Rapid Transit District as part of their program of station construction, the exact amount to be determined by negotiation between BARTD and the City. Some may also be borne by the Division of Highways. The bulk of the costs, however, will be the responsibility of the City of Berkeley.

The total cost of projects which should be accomplished prior to the opening of the rapid transit stations to service is approximately $4.3 million. Additional construction needed to provide a trafficways system adequate for the projected 1970 needs will require the expenditure of an additional $6.1 million, bringing the total cost for the period to approximately $10.4 million. By way of comparison, the current capital improvement program for major street construction (revised March 1964) of the City of Berkeley allocates for the period 1964-'69 approximately $5.2 million, to which must be added the costs for which BARTD will be responsible.

Of the $24 million program recommended for the period from 1970 to 1980, the greatest single cost item is for the improvement of Ashby Avenue to major street standards. It has been estimated that $8.84 million will be required for this one project -- $7.4 million of which is in the '70-'80 program (31 percent of the total cost of the 10-year program). Because Ashby Avenue is a State Highway, some portion of this cost may be expected to be borne by the Division of Highways. Although no attempt has been made to estimate the possible extent of State participation, if the City were to be responsible for the acquisition of cleared right-of-way only, its share would be about $6 million. However, this calculation is not intended to represent a conclusion regarding a reasonable sharing of costs, but only to aid in assessing the order to magnitude of the problem of equity. Other major second phase projects include the widening of Dwight Way to six lanes ($3.0 million), and its connection with the proposed Shoreline Freeway (4.5 million), the widening of Grove Street to 64 feet ($2.6 million), the widening of Cedar Street to 44 feet ($1.3 million), and the widening of Gilman Street ($1.3 million). The remaining $3.9 million would cover 30 other projects listed in Table 12.

APPENDIX A

TRAFFIC SUFFICIENCY RATINGS
SELECTED STREETS

N-S STREETS	FROM	TO	(0-50) DELAY RATE/MILE DURING OFF-PEAK	(0-15) COLLISION INDEX	(0-15) STRUCTURAL CONDITION	(0-20) TRAFFIC	(0-100) RATING
West Frontage Rd.	Gilman St.	University Ave.	2	11	9	3	25
	University Ave.	City Limit	1	5	9	3	18
East Frontage Rd.	Gilman St.	University Ave.	2	6	4	3	15
6th St. - 7th St.	Gilman St.	Cedar St.	3	14	7	4	28
	Cedar St.	University Ave.	5	15	6	5	31
	University Ave.	Dwight Way	6	8	4	7	25
	Dwight Way	Ashby Ave.	6	4	12	7	29
San Pablo Ave.	City Limit	Gilman St.	0	7	11	13	31
	Gilman St.	Cedar St.	5	11	9	12	37
	Cedar St.	University Ave.	13	9	9	15	46
	University Ave.	Dwight Way	13	15	9	14	51
	Dwight Way	Ashby Ave.	17	10	9	14	50
	Ashby Ave.	City Limit	15	10	9	12	46
Santa Fe Ave. - Cornell Ave.	City Limit	Hopkins St.	4	5	9	3	21
Sacramento Ave.	Hopkins St.	Rose St.	12	5	12	7	36
	Rose St.	Cedar St.	12	5	5	7	29
	Cedar St.	University Ave.	12	5	5	8	30
	University Ave.	Dwight Way	8	13	8	8	37
	Dwight Way	Oregon St.	10	6	0	10	26
	Oregon St.	Ashby Ave.	10	6	12	10	38
	Ashby Ave.	Alcatraz Ave.	20	11	12	11	54
Colusa Ave.	City Limit	Solano Ave.	3	4	9	5	21
	Solano Ave.	Monterey Ave.	5	6	8	2	21
Monterey Ave.	The Alameda	Hopkins St.	2	3	7	4	16
Grove St. - The Alameda	Solano Ave.	Hopkins St.	0	2	8	7	17
	Hopkins St.	Rose St.	9	2	10	11	32
	Rose St.	Cedar St.	15	3	10	11	39
	Cedar St.	University Ave.	7	4	12	13	36
	University Ave.	Dwight Way	0	6	12	10	28
	Dwight Way	Ashby Ave.	9	7	12	10	38
	Ashby Ave.	Adeline St.	1	15	12	8	36
Milvia St.	Rose St.	Hearst Ave.	3	15	8	2	28
	Hearst Ave.	University Ave.	3	15	0	2	20
	University Ave.	Channing Way	(UNDER CONST.)	15	6	5	26
	Channing Way	Dwight Way	(UNDER CONST.)	15	11	5	31
Solano Ave. - Sutter St. Henry St. - Shattuck Place Shattuck Ave. - Adeline St.	The Alameda	Rose St.	1	5	0	6	12
	Rose St.	Cedar St.	25	6	0	10	41
	Cedar St.	Hearst Ave.	14	4	0	11	29
	Hearst Ave.	University Ave.	50	15	2	11	78
	University Ave.	Dwight Way	19	15	12	13	59
	Dwight Way	Ashby Ave.	16	11	13	9	49
	Ashby Ave.	Alcatraz Ave.	17	15	12	9	53
	Alcatraz Ave.	City Limit	17	15	12	8	52
Shattuck Ave.	Adeline St.	South City Limit	9	15	12	7	43
Spruce St. - Oxford St. - Fulton St.	Grizzly Peak Blvd.	Marin Ave.	0	2	10	4	16
	Marin Ave.	Rose St.	5	2	10	6	23
	Rose St.	Cedar St.	11	5	8	7	31
	Cedar St.	Hearst Ave.	50	6	8	10	74
	Hearst Ave.	Bancroft Way	50	4	0	16	70
	Bancroft Way	Dwight Way	15	15	9	8	47
	Dwight Way	Ashby Ave.	12	9	9	5	35
Ellsworth St.	Ashby Ave.	Dwight Way	9	15	12	4	40
	Dwight Way	Bancroft Way	14	15	12	4	45
Arlington Ave.	City Limits	Marin Ave.	4	5	14	6	29
Euclid Ave.	Grizzly Peak Blvd.	Marin Ave.	3	1	12	2	18
	Marin Ave.	Cedar St.	8	4	12	4	30
	Cedar St.	Hearst Ave.	20	15	12	6	53
Telegraph Ave.	Bancroft Way	Dwight Way	50	15	15	6	86
	Dwight Way	Ashby Ave.	6	11	10	10	37
	Ashby Ave.	City Limit	6	12	10	10	38
College Ave.	Bancroft Way	Dwight Way	2	15	9	4	30
	Dwight Way	Ashby Ave.	8	15	6	5	34
	Ashby Ave.	Alcatraz Ave.	18	5	6	8	37
Grizzly Peak Blvd.	North City Limit	Marin Ave.	3	4	3	3	13
	Marin Ave.	Shasta Rd.	1	6	3	2	12
	Shasta Rd.	South City Limit	0	15	3	1	19
Gayley Rd.-Piedmont Ave.- Warring St.-Derby St.- Belrose Ave.-Claremont Blvd.	Hearst Ave.	Bancroft Way	10	2	15*	10	37
	Bancroft Way	Durant Ave.	10	2	12	10	34
	Durant Ave.	Dwight Way	2	7	12	9	30
	Dwight Way	Derby St.	5	3	2	9	19
	Warring St.	Belrose Ave.	5	2	2	9	18
	Derby St.	Claremont Ave.	5	2	6	9	22
Claremont Ave.	City Limit (South)	Ashby Ave.	7	5	3	6	21
	Ashby Ave.	City Limit (East)	1	15	0	1	17

APPENDIX A (CONT'D.)

TRAFFIC SUFFICIENCY RATINGS
SELECTED STREETS

E-W STREETS	FROM	TO	(0-50) DELAY RATE/MILE DURING OFF-PEAK	(0-15) COLLISION INDEX	(0-15) STRUCTURAL CONDITION	(0-20) TRAFFIC	(0-100) RATING
Solano Ave.	City Limit	The Alameda	0	8	10	7	25
Marin Ave.	City Limit	The Alameda	14	3	10	4	31
	The Alameda	The Circle	5	3	3	5	16
	The Circle	Spruce St.	0	5	0	2	7
	Spruce St.	Euclid Ave.	2	2	0	2	6
	Euclid Ave.	Grizzly Peak Blvd.	0	5	0	2	7
Eunice St.	Henry St.	Spruce St.	2	15	13	1	31
	Spruce St.	Euclid Ave.	1	15	12	2	30
Gilman St.	E. Frontage Rd.	6th St.	20	15	15	8	58
	6th St.	San Pablo Ave.	22	8	12	9	51
	San Pablo Ave.	Hopkins St.	5	6	8	8	27
Hopkins St.	San Pablo Ave.	Sacramento St.	4	5	12	4	25
	Sacramento St.	The Alameda	0	2	12	5	19
	The Alameda	Sutter St.	5	5	15	3	28
Rose St.	Hopkins St.	Sacramento St.	2	5	9	2	18
	Sacramento St.	Grove St.	2	7	12	2	23
	Grove St.	Henry St.	18	6	0	4	28
	Henry St.	Spruce St.	6	15	9	4	34
Cedar St. - La Loma Ave. -	E. Frontage Rd.	6th St.	10	15	7	3	35
	6th St.	San Pablo Ave.	10	15	4	5	34
Shasta Rd.	San Pablo Ave.	Sacramento St.	1	10	13	3	27
	Sacramento St.	Grove St.	10	4	0	5	19
	Grove St.	Shattuck Ave.	3	12	8	5	28
	Shattuck Ave.	Spruce St.	9	6	8	5	28
	Spruce St.	La Loma Ave.	6	5	6	4	21
	Cedar St.	Glendale Ave.	0	4	14	2	20
	Glendale Ave.	Grizzly Peak Blvd.	0	4	12	2	18
Hearst Ave.	Sacramento St.	Grove St.	3	9	12	4	28
	Grove St.	Shattuck Ave.	16	15	0	5	36
	Shattuck Ave.	Oxford St.	7	12	6	7	32
	Oxford St.	Arch St.	7	12	0	7	26
	Arch St.	Euclid Ave.	7	12	12	7	38
	Euclid Ave.	Gayley Rd.	7	12	0	7	26
University Ave.	E. Frontage Rd.	6th St.	0	5	10	18	33
	6th St.	San Pablo Ave.	50	15	10	16	91
	San Pablo Ave.	Sacramento St.	30	12	10	18	70
	Sacramento St.	Grove St.	50	6	10	18	84
	Grove St.	Shattuck Ave.	50	8	10	16	84
	Shattuck Ave.	Oxford St.	6	15	10	6	37
Allston Way	6th St.	San Pablo Ave.	1	15	13	1	30
	San Pablo Ave.	Sacramento St.	3	15	13	3	34
	Sacramento St.	Grove St.	3	15	9	3	30
	Grove St.	Shattuck Ave.	6	15	6	4	31
	Shattuck Ave.	Oxford St.	15	15	11	3	44
Bancroft Way	Piedmont Ave.	College Ave.	0	8	7	4	19
	College Ave.	Telegraph Ave.	8	13	7	7	35
	Telegraph Ave.	Fulton Ave.	16	6	7	9	38
Durant Ave.	Shattuck Ave.	Telegraph Ave.	11	13	12	6	42
	Telegraph Ave.	College Ave.	2	15	13	5	35
	College Ave.	Piedmont Ave.	9	15	12	3	39
Haste St.	Piedmont Ave.	College Ave.	19	15	0	2	36
	College Ave.	Telegraph Ave.	11	15	0	4	30
	Telegraph Ave.	Shattuck Ave.	4	15	0	4	23
	Shattuck Ave.	Grove St.	11	15	1	4	31
Dwight Way	7th St.	San Pablo Ave.	50	15	12	4	81
	San Pablo Ave.	Sacramento St.	17	7	3	7	34
	Sacramento St.	Grove St.	5	5	1	6	17
	Grove St.	Shattuck Ave.	10	15	6	5	36
	Shattuck Ave.	Telegraph Ave.	12	14	12	5	43
	Telegraph Ave.	College Ave.	5	12	12	5	34
	College Ave.	Piedmont Ave.	1	9	12	4	26
Ashby Ave. - Tunnel Rd.	7th St.	San Pablo Ave.	15	15	6	16	52
	San Pablo Ave.	Sacramento St.	20	15	10	15	60
	Sacramento St.	Grove St.	19	12	13	15	59
	Grove St.	Adeline St.	23	15	13	14	65
	Adeline St.	Fulton St.	41	8	10	15	74
	Fulton St.	Telegraph Ave.	28	13	8	16	65
	Telegraph Ave.	College Ave.	50	9	8	12	79
	College Ave.	Claremont Ave.	23	4	12	15	54
	Claremont Ave.	City Limit	2	3	15	20	40
Alcatraz Ave.	West City Limit	Sacramento St.	14	15	15	5	49
	Sacramento St.	Adeline St.	14	15	12	5	46
	Adeline St.	East City Limit	14	15	12	5	46

Appendix B
QUARTILE DISTRIBUTION TRAFFIC SUFFICIENCY RATINGS, SELECTED TRAFFICWAYS

LEGEND

HIGHEST SCORE

SECOND SCORE

THIRD SCORE

LOWEST SCORE

NOTE: Highest Scores Denote Greatest Deficiencies in Traffic Service

NORTH

0 1 2 3 4 5 6

MAP SCALE IN THOUSANDS OF FEET

BERKELEY TRAFFICWAYS

Wilbur Smith and Associates

WILBUR SMITH
AND ASSOCIATES